

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.; AND
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner

v.

INVENSAS BONDING TECHNOLOGIES, INC.,
Patent Owner

Patent No. 9,391,143

**DECLARATION OF SYLVIA HALL-ELLIS, PH.D.
CONCERNING PUBLICITY AND PUBLIC ACCESSIBILITY**

I. INTRODUCTION

1. My name is Sylvia D. Hall-Ellis. I have been asked to submit this declaration on behalf of Defendants, Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Petitioner”). I have been retained as an expert by Petitioner to study and provide opinions regarding when two particular publications were published and publicly accessible.

2. My declaration sets forth my opinions based on the information identified and the analysis I have performed through the date of this declaration. This declaration and my opinions contained herein are subject to change or modification if additional relevant information becomes available that bears on my analysis.

II. EXPERIENCE AND COMPENSATION

3. Information concerning my professional qualifications, experience, publications, and presentations in the field of library sciences in which I have served as an expert are set forth in my current Curriculum Vitae, attached hereto as **Exhibit A**.

4. I am currently an Adjunct Professor in the School of Information at San José State University. I obtained a Masters of Library Science from the University of North Texas in 1972 and a Ph.D. in Library Science from the University of Pittsburgh in 1985. Over the last forty-five years, I have held various positions in the field of library and information resources. I was first employed as a librarian in 1966, and have been involved in the field of library sciences since, holding numerous positions.

5. I am a member of the American Library Association (ALA) and its Association for Library Collections & Technical Services (ALCTS) Division, and I served on the Committee on Cataloging: Resource and Description (which wrote the new cataloging rules) and as the chair of the Committee for Education and Training of Catalogers and the Competencies and Education for a Career in Cataloging Interest Group. I also served as the Chair of the ALCTS Division’s

Task Force on Competencies and Education for a Career in Cataloging. Additionally, I have served as the Chair for the ALA Office of Diversity's Committee on Diversity and as a member of the REFORMA National Board of Directors. Currently I serve as a member of the Editorial Board for the ALCTS premier cataloging journal, *Library Resources and Technical Services*.

6. I have also given over one hundred presentations in the field, including several on library cataloging systems and Machine-Readable Cataloging ("MARC") standards. My current research interests include library cataloging systems, metadata, and organization of electronic resources.

7. I am being compensated for my time spent working on this matter at my usual and customary consulting rate of \$300 per hour, plus reimbursement for any additional reasonable expenses. My compensation is not in any way tied to the content of this declaration, the substance of my opinions, or the outcome of this litigation. I have no other interests in this proceeding or with any of the parties.

III. PRELIMINARIES AND LEGAL STANDARDS

8. *Scope of this declaration.* I am not an attorney and will not offer opinions on the law. I am, however, rendering my expert opinion on the authenticity of the documents referenced herein and on when and how each of these documents was disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, could have located the documents before February 16, 2000.

9. I am informed by counsel that a printed publication qualifies as publicly accessible as of the date it was disseminated or otherwise made available such that a person interested in and ordinarily skilled in the relevant subject matter could locate it through the exercise of ordinary diligence.

10. While I understand that the determination of public accessibility under the foregoing standard rests on a case-by-case analysis of the facts particular to an individual publication, I also understand that a printed publication is rendered “publicly accessible” if it is cataloged and indexed by a library such that a person interested in the relevant subject matter could locate it (*i.e.*, I understand that cataloging and indexing by a library is sufficient, though there are other ways that a printed publication may qualify as publicly accessible). One manner of sufficient indexing is indexing according to subject matter category. I understand that the cataloging and indexing by a single library of a single instance of a particular printed publication is sufficient, even if the single library is in a foreign country. I understand that, even if access to a library is restricted, a printed publication that has been cataloged and indexed therein is publicly accessible so long as a presumption is raised that the portion of the public concerned with the relevant subject matter would know of the printed publication. I also understand that the cataloging and indexing of information that would guide a person interested in the relevant subject matter to the printed publication, such as the cataloging and indexing of an abstract for the printed publication, is sufficient to render the printed publication publicly accessible.

11. I understand that routine business practices, such as general library cataloging and indexing practices, can be used to establish an approximate date on which a printed publication became publicly accessible.

12. In preparing this declaration, I used authoritative databases, such as the OCLC Connexion database, to confirm citation details of the publication discussed.

13. *Indexing.* A researcher may discover material relevant to his or her topic in a variety of ways. One common means of discovery is to search for relevant information in an index of periodical and other publications. Having found relevant material, the researcher will

then normally obtain it online, look for it in libraries, or purchase it from the publisher, a bookstore, a document delivery service, or other provider. Sometimes, the date of a document's public accessibility will involve both indexing and library date information.

14. Indexing services use a wide variety of controlled vocabularies to provide subject access and other means of discovering the content of documents. The formats in which these access terms are presented vary from service to service.

15. Online indexing services commonly provide bibliographic information, abstracts, and full-text copies of the indexed publications, along with a list of the documents cited in the indexed publication. These services also often provide lists of publications that cite a given document. A citation of a document is evidence that the document was publicly available and in use by researchers no later than the publication date of the citing document.

IV. LIBRARY CATALOGING PRACTICES

16. I am fully familiar with the library cataloging standard known as the MARC standard, which is an industry-wide standard method of storing and organizing library catalog information.¹ MARC was first developed in the 1960's by the Library of Congress. A MARC-compatible library is one that has a catalog consisting of individual MARC records for each of its items. Today, MARC is the primary communications protocol for the transfer and storage of bibliographic metadata in libraries.²

¹ The full text of the standard is available from the Library of Congress at <http://www.loc.gov/marc/bibliographic/>.

² Almost every major library in the world is MARC-compatible. *See, e.g., MARC Frequently Asked Questions (FAQ)*, LIBRARY OF CONGRESS, <https://www.loc.gov/marc/faq.html> (last visited September 10, 2018) ("MARC is the acronym for MACHine-Readable Cataloging. It defines a data format that emerged from a Library of Congress-led initiative that began nearly forty years ago. It provides the mechanism by which computers exchange, use, and interpret bibliographic information, and its data elements make up the foundation of most library catalogs used today.").

17. A MARC record comprises several fields, each of which contains specific data about the work. Each field is identified by a standardized, unique, three-digit code corresponding to the type of data that follow. For example, a work's title is recorded in field 245, the primary author of the work is recorded in field 100, an item's International Standard Book Number ("ISBN") is recorded in field 020, an item's Library of Congress call number is recorded in field 050, and the publication date is recorded in field 260 under the subfield "c." If a work is a periodical, then its publication frequency is recorded in field 310, and the publication dates (e.g., the first and last publication) are recorded in field 362, which is also referred to as the enumeration/chronology field.

18. The library that created the record is recorded in field 040 in subfield "a" with a unique library code. When viewing the MARC record online via Online Computer Library Center's ("OCLC") Connexion database, hovering over this code with the mouse reveals the full name of the library. I used this method of "mousing over" the library codes in the OCLC database to identify the originating library for the MARC records discussed in this declaration. Where this "mouse over" option was not available, I consulted the Directory of OCLC Libraries in order to identify the institution that created the MARC record.³

19. MARC records also include several fields that include subject matter classification information. An overview of MARC record fields is available through the Library of Congress at <http://www.loc.gov/marc/bibliographic/>. For example, 6XX fields are termed

MARC is the ANSI/NISO Z39.2-1994 (reaffirmed 2016) standard for Information Interchange Format.

³ <https://www.oclc.org/en/contacts/libraries.html>

“Subject Access Fields.” See <http://www.loc.gov/marc/bibliographic/bd6xx.html>. Among these, for example, is the 650 field; this is the “Subject Added Entry – Topical Term” field. See <http://www.loc.gov/marc/bibliographic/bd650.html>. The 650 field is a “[s]ubject added entry in which the entry element is a topical term.” *Id.* These entries “are assigned to a bibliographic record to provide access according to generally accepted thesaurus-building rules (e.g., *Library of Congress Subject Headings* (LCSH), *Medical Subject Headings* (MeSH)).” *Id.* Further, MARC records include call numbers, which themselves include a classification number. For example, the 050 field is the “Library of Congress Call Number.” See <http://www.loc.gov/marc/bibliographic/bd050.html>. A defined portion of the Library of Congress Call Number is the classification number, and “source of the classification number is *Library of Congress Classification* and the *LC Classification-Additions and Changes*.” *Id.* Thus, included in the 050 field is a subject matter classification. Each item in a library has a single classification number. A library selects a classification scheme (e.g., the Library of Congress Classification scheme just described or a similar scheme such as the Dewey Decimal Classification scheme) and uses it consistently. When the Library of Congress assigns the classification number, it appears as part of the 050 field. If a local library assigns the classification number, it appears in a 090 field. In either scenario, the MARC record includes a classification number that represents a subject matter classification.

20. The OCLC was created “to establish, maintain and operate a computerized library network and to promote the evolution of library use, of libraries themselves, and of librarianship, and to provide processes and products for the benefit of library users and libraries, including such objectives as increasing availability of library resources to individual library patrons and reducing the rate of rise of library per-unit costs, all for the fundamental public purpose of

furthering ease of access to and use of the ever-expanding body of worldwide scientific, literary and educational knowledge and information.”⁴ Among other services, OCLC and its members are responsible for maintaining the WorldCat database (<http://www.worldcat.org/>), used by independent and institutional libraries throughout the world.

21. OCLC also provides its members online access to MARC records through its OCLC Connexion database. When an OCLC member institution acquires a work, it creates a MARC record for this work in its computer catalog system in the ordinary course of its business. MARC records created at the Library of Congress are tape-loaded into the OCLC database through a subscription to MARC Distribution Services daily or weekly. Once the MARC record is created by a cataloger at an OCLC member institution or is tape-loaded from the Library of Congress, the MARC record is then made available to any other OCLC members online, and therefore made available to the public. Accordingly, once the MARC record is created by a cataloger at an OCLC member institution or is tape-loaded from the Library of Congress or another library anywhere in the world, any publication corresponding to the MARC record has been cataloged and indexed according to its subject matter such that a person interested in that subject matter could, with reasonable diligence, locate and access the publication through any library with access to the OCLC Connexion database or through the Library of Congress.

22. When an OCLC member institution creates a new MARC record, OCLC automatically supplies the date of creation for that record. The date of creation for the MARC

⁴ Third Article, Amended Articles of Incorporation of OCLC Online Computer Library Center, Incorporated (available at <https://www.oclc.org/content/dam/oclc/membership/articles-of-incorporation.pdf>).

record appears in the fixed field (008), characters 00 through 05. The MARC record creation date reflects the date on which, or shortly after which, the item was first acquired or cataloged. Initially, field 005 of the MARC record is automatically populated with the date the MARC record was created in year, month, day format (YYYYMMDD) (some of the newer library catalog systems also include hour, minute, second (HHMMSS)). Thereafter, the library's computer system may automatically update the date in field 005 every time the library updates the MARC record (*e.g.*, to reflect that an item has been moved to a different shelving location within the library). Field 005 is visible when viewing a MARC record via an appropriate computerized interface, but when a MARC record is printed to hardcopy, no "005" label appears. The initial field 005 date (*i.e.*, the date the MARC record was created) does appear, however, next to the label "Entered."⁵ The date upon which the most recent update to field 005 occurred also appears, next to the label "Replaced." Thus, when an item's MARC record has been printed to hardcopy—as is the case with the exhibits to this declaration—the date reflected next to the label "Entered" is necessarily on or after the date the library first cataloged and indexed the underlying item.

23. Once one library has cataloged and indexed a publication by creating a MARC record for that publication, other libraries that receive the publication do not create additional MARC records—the other libraries instead rely on the original MARC record. They may update or revise the MARC record to ensure accuracy, but they do not replace or duplicate it. This practice does more than save libraries from duplicating labor. It also enhances the accuracy of MARC records. Further, it allows librarians around the world to know that a particular MARC

⁵ In this declaration, I sometimes refer to the "Entered" entry as field 008, characters 00-05.

record is authoritative (in contrast, a hypothetical system wherein duplicative records were created would result in confusion as to which record is authoritative).

24. The date of creation of the MARC record by a cataloger at an OCLC member institution reflects when the underlying item is accessible to the public. Upwards of two-thirds to three-quarters of book sales to libraries come from a jobber or wholesaler for online and print resources. These resellers make it their business to provide books to their customers as fast as possible, often providing turnaround times of only a single day after publication. Libraries purchase a significant portion of the balance of their books directly from publishers themselves, which provide delivery on a similarly expedited schedule. In general, libraries make these purchases throughout the year as the books are published and shelve the books as soon thereafter as possible in order to make the books available to their patrons. Thus, books are generally available at libraries across the country within just a few days of publication.

V. OPINIONS

A. Reiche

25. Attached hereto as **Exhibit 1-A** is a true and correct copy of a conference paper, “The Effect of a Plasma Pretreatment on the Si/Si Bonding Behaviour,” by M. Reiche, K. Gutjahr, D. Stolze, D. Burczyk, and M. Petzold (hereafter “Reiche”) that was published on pages 437-444 in the proceedings volume, *Proceedings of the International Symposium on Wafer Bonding*, which is Electrochemical Society Proceedings, vol. 97-36, edited by Ulrich Gösele, Helmut Baumgart, Takano Abe, Charles Hunt, and S. Iyer and issued by the Electrochemical Society in 1998. The exhibit filed in this proceeding as **Exhibit 1-A** is a true and correct copy of the title page, title page verso, preface, table of contents, and conference paper from the Linda Hall Library. I obtained this book from the Linda Hall Library and made the copies which comprise **Exhibit 1-A**. Specifically, the text is complete; no pages are missing, and the text on

each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. **Exhibit 1-A** was found within the custody of a library – a place where, if authentic, a copy of this book would likely be. **Exhibit 1-A** is a true and correct copy in a condition that creates no suspicion about its authenticity.

26. Attached hereto as **Exhibit 1-B** is a true and correct copy of the MARC record for this monograph from the Linda Hall Library. The library ownership is indicated by the presence of the library's code (LHL) in the 049 field. I personally identified and retrieved the library catalog record which is **Exhibit 1-B**.

27. Based on finding a print copy of **Exhibit 1-A** in the Linda Hall Library and MARC record in its online library catalog attached as **Exhibit 1-B**, it is my opinion that the book *Proceedings of the International Symposium on Wafer Bonding*, edited by Gösele, *et. al.*, was available in the Linda Hall Library as of March 30, 1998, as shown in Field 008.

28. Attached hereto as **Exhibit 1-C** is a true and correct copy of the MARC record for *Proceedings of the International Symposium on Wafer Bonding*, edited by Gösele, *et. al.* obtained from the OCLC Connexion database. I personally identified and retrieved the MARC record that is **Exhibit 1-C**. As previously noted, the library that transcribed the record is recorded in field 040 with a unique library code. For **Exhibit 1-C**, that library code is "DLC," which means that the MARC record for this book was created at the Library of Congress. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. As can be seen in the "Entered" field in the MARC record for this exhibit, a cataloger at the Library of Congress created OCLC record number 38865487 on March 30, 1998.

29. **Exhibit 1-C** further includes an entry in field 050 ("TK7871.85 ßb .I5838 1997")—as described above, this includes a subject matter classification number consistent with

the Library of Congress classification system (analogous to the Dewey Decimal System).

Exhibit 1-C further includes an entry in field 082 (“621.3815/2”), a subject matter consistent with the Dewey Decimal Classification System. **Exhibit 1-C** further includes three English language field 650 entries reading “Semiconductors ‡x Bonding ‡v Congresses,” “Semiconductor wafers ‡v Congresses,” and “Electromechanical systems ‡x Design and construction ‡v Congresses.” Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as **Exhibit 1-C** was indexed according to its subject matter by virtue of at least three independently sufficient classifications: the field 050 entry, the field 082 entry, and the field 650 entries. Further, as of March 30, 1998, the MARC record attached hereto as **Exhibit 1-C** was accessible through any library with access to the OCLC Connexion database or the online catalog at a library that acquired this book, which means that the corresponding publication was publicly available on or before that same date through any library with access to the OCLC Connexion database or through an individual library.

30. **Exhibit 1-C** indicates that the book *Proceedings of the International Symposium on Wafer Bonding*, edited by Gösele, *et. al.*, as cataloged at the Library of Congress is currently available from 33 libraries. In view of above, this monograph *Proceedings of the International Symposium on Wafer Bonding*, edited by Gösele, *et. al.* was publicly available no later than March 30, 1998, because by that date it had been cataloged and indexed at the Library of Congress, made part of the OCLC Connexion database, and received at the Linda Hall Library. For these reasons, it is my opinion that **Exhibit 1-A** was published and accessible to the public no later than March 30, 1998.

B. Li

31. Attached hereto as **Exhibit 2-A** is a true and correct copy of the print issue of Volume 37, Number 3A of the *Japanese Journal of Applied Physics, Part 1*. The article “Systematic Low Temperature Silicon Bonding Using Pressure and Temperature” by Y. Albert Li and Robert W. Bower (hereafter “Li”) appears beginning on page 737 of this issue dated March 1998.

32. **Exhibit 2-A** has a stamp affixed at the Linda Hall Library which shows that it was received, verified, and checked in on May 8, 1998. Therefore, this issue of the *Japanese Journal of Applied Physics, Part 1* was available to users at the Linda Hall Library on that date.

33. Attached hereto as **Exhibit 2-B** is a true and correct copy of the MARC record for the *Japanese Journal of Applied Physics, Part 1* at the Linda Hall Library. The library ownership is indicated by the presence of the library’s code (LHL) in the 049 field. I personally identified and retrieved the MARC record that is **Exhibit 2-B**.

34. Based on finding a print copy of the Li article in the Linda Hall Library and MARC record in its online library catalog attached as **Exhibit 2-B**, it is my opinion that the Li article published in the *Japanese Journal of Applied Physics, Part 1* was available at the Linda Hall Library on May 8, 1998.

35. As noted in the holdings information, the Linda Hall Library has received the *Japanese Journal of Applied Physics, Part 1* since the publication began in January 1982 and received the publication until it ceased in December 2007.⁶ In view of the MARC record for

⁶ The publication began as *Japanese Journal of Applied Physics* (July 1962-December 1981). At that time, the publication split into two journals: *Japanese Journal of Applied Physics. Part 1, Regular Papers & Short Notes*; and: *Japanese Journal of Applied Physics. Part 2, Letters* (1982-2007).

Exhibit 2-A, the Li article was publicly available no later than May 8, 1998, because the serial title had been cataloged and indexed at the Linda Hall Library and made part of its online catalog database.

36. Attached hereto as **Exhibit 2-C** is a true and correct copy of the MARC record for the *Japanese Journal of Applied Physics* obtained from the OCLC Connexion database. I personally identified and retrieved the MARC record that is **Exhibit 2-C**. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For **Exhibit 2-C**, that library code is “YDM,” which means that the MARC record for this serial was cataloged at the New York College of Ceramics at Alfred University Library. As can be seen in the “Entered” field in the MARC record, a cataloger at the New York College of Ceramics at Alfred University Library created OCLC record number 8270740 on March 24, 1982. The “BLvl” entry in **Exhibit 2-C** is “s,” which indicates that the journal *Materials Chemistry and Physics* is a serial publication. Field 310 of **Exhibit 2-C** reads “Monthly.” Accordingly, the MARC record for **Exhibit 2-C** corresponds to those issues of the *Japanese Journal of Applied Physics* when the Li article was published.

37. **Exhibit 2-C** further includes an entry in field 050 (“QC1 ‡b .J28”)—as described above, this includes a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal System). **Exhibit 2-C** further includes an entry in field 082 (“620/.005”), a subject matter consistent with the Dewey Decimal Classification System. **Exhibit 2-C** further includes two English language field 650 entries reading “Physics ‡v Periodicals” and “Technology ‡v Periodicals.” Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as **Exhibit 2-C** was indexed according to its subject matter by virtue of at least three independently sufficient classifications:

the field 050 entry, the field 082 entry, and the field 650 entries. Further, as of March 24, 1982, the MARC record attached hereto as **Exhibit 2-C** was accessible through any library with access to the OCLC Connexion database or the online catalog at a library regularly subscribed to this serial, which means that the corresponding publication was publicly available on or before that same date through any library with access to the OCLC Connexion database or through an individual library.

38. **Exhibit 2-C** indicates that the *Japanese Journal of Applied Physics* as cataloged at the New York College of Ceramics at Alfred University Library is currently available from 287 libraries. In view of above, this issue of the *Japanese Journal of Applied Physics* was publicly available no later than May 8, 1998, because by that date it had been cataloged and indexed at the New York College of Ceramics at Alfred University Library, made part of the OCLC Connexion database, and received at the Linda Hall Library. For these reasons, it is my opinion that **Exhibit 2-A** was published and accessible to the public no later than May 8, 1998.

VI. SUMMARY OF OPINIONS AND CONCLUSION

39. In view of the foregoing, it is my opinion that the publications described above were publicly available no later than the corresponding date listed in the table below:

Exhibit	Publication	Publicly Available No Later Than
1	Reiche, M., K. Gutjahr, D. Stolze, D. Burezyk, and M. Petzold. "The Effect of a Plasma Pretreatment on the Si/Si Bonding Behaviour." In the <i>Proceedings of the International Symposium on Wafer Bonding</i> (pp. 437-444). Edited by Ulrich Gösele, Helmut Baumgart, Takano Abe, Charles Hunt, and S. Iyer. Electrochemical Society Proceedings, vol. 97-36. Pennington, NJ: Electrochemical Society, c1998.	March 30, 1998
2	Li, Y. Albert, and Robert W. Bower. "Systematic Low Temperature Silicon Bonding Using Pressure and Temperature." <i>Japanese Journal of Applied Physics</i> , vol. 37, Part 1, Number 3A (1998): 737-741.	May 8, 1998

40. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

41. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct and that the foregoing is based upon personal knowledge and information and is believed to be true.

DATED: September 30, 2018

By:


Dr. Sylvia D. Hall-Ellis

Exhibit A

**CURRICULUM VITAE
SYLVIA D. HALL-ELLIS**

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EDUCATION

Ph.D., University of Pittsburgh, Pittsburgh, Pennsylvania, 1985
M.P.S., University of Denver, Denver, Colorado, 2014
Post Graduate Studies, University of Texas – San Antonio, Texas, 1975-1976
M.L.S., University of North Texas, Denton, Texas, 1972
B.A., Rockford University, Rockford, Illinois, 1971

PROFESSIONAL EXPERIENCE

- 1981- Consultant for higher education, non-profit organizations, and corporations.**
- 2002- Adjunct Professor, School of Information, San José State University, San José, California.** Serve as part-time faculty member teaching graduate students in technical services (cataloging, bibliographic control, classification), “core courses,” and special topics.
- 2014-2016 Director, Grants and Resource Development, Colorado Community College System.** Provided leadership and vision to foster the continued growth of rigorous scholarship, innovative projects, and creative work for statewide system, 13 campuses, and 50 teaching sites serving 155,000 students. Responsible for leadership and ensured efficient functioning of contract and grants in compliance with state & federal requirements and successful implementation and management. Served as a subject matter expert and liaison for college Grant Directors for all issues relating to grants and subcontracts.
- 2010-2014 Senior Grant Administrator, Morgridge College of Education, University of Denver (Colorado).** Provided leadership and vision to foster continued growth of rigorous scholarship, innovative research, and creative work in the Morgridge College of Education. Ensure that contract and grants processes function effectively and efficiently for 60 faculty and researchers with a focus on the successful progression and efficient management of grants totaling \$13M. Worked effectively and collegially with Department Chairs and Program Coordinators on operational grant-related management activities and with a broad range of internal and external constituencies. Supported the dissemination and promotion of faculty research and scholarship to outside constituents at conferences and through publications. Assisted Principal Investigators and grant project teams by coaching, mentoring, and financial management.
- 2011-2013 Interim Director & Assistant Dean, Westminster Law Library, Sturm College of Law, University of Denver.** Planned, organized, and directed all administrative activities for the library serving students, faculty, and alumni; oversaw the employment, retention, promotion, transfer and termination of library personnel; represented the library at professional conferences and public meetings; created and promoted a climate and culture of acceptance for new programs and services, a positive high-quality image of the law library, and that reflect the organization’s values, encourage excellent performance, and reward high productivity and innovation; provided leadership and set strategic direction of the organization; ensured that the library provided excellent customer service through solution-oriented staff response to patron needs and by responsiveness and continuous improvement of the organization; promoted, developed, and maintained positive working relationships with colleagues and customers including key stakeholders and groups, higher education institutions, the legal community, other regional libraries and districts statewide, and national library organizations.

- 2007-2014** **Associate Professor, Library & Information Science, Morgridge College of Education, University of Denver (Colorado).** Served in leadership role and worked collaboratively in program, college, campus and community environments. Advised and supervised students, taught core and specialized courses at the graduate level in an integrative, student-centered learning environment. Served on LIS, College, and University committees, and maintained working relationships with colleagues in other academic units and information professionals in the Rocky Mountain region and beyond. Served on and chair doctoral student dissertation committees. Oversaw and facilitated the College and LIS graduate student association.
- 2002-2007** **Assistant Professor, Library & Information Science, College of Education, University of Denver (Colorado).** Served as tenure-track faculty member teaching graduate students in “core courses,” resource description and access, service learning, and independent studies. Advised graduate students, participate on LIS and College committees, and serve on doctoral student dissertation committees. Oversaw and facilitated the LIS graduate student association and alumni association.
- 2000-2002** **Affiliate Faculty, Library & Information Science, College of Education, University of Denver (Colorado).** Served as part-time faculty member teaching graduate students in technical services (cataloging, bibliographic control, classification), “core courses,” and special topics. Oversaw and facilitated the LIS graduate student association and alumni association.
- 2000-2001** **Special Assistant to the Secretary’s Regional Representative, U.S. Department of Education, Region VIII, Denver, Colorado.** Served as the principal advisor and representative of the U. S. Secretary of Education’s Regional Representative (SRR). Ensured the implementation of major goals of the SRR and the Secretary. Provided leadership on behalf of the SRR in contacts with high-level officials in Region VIII requiring sensitive policy interpretation in communication with senior Department officials to solve problems and resolve issues raised by State and local education officials. Served as the primary contact for School-to-Work/Career, Children’s Health Insurance Program, and Safe and Drug-Free Schools. Delivered technical assistance to local education agencies and institutions of higher education in technology, professional development, and school construction.
- 1999-2000** **Catalog Librarian, Jefferson County Public Library, Lakewood, Colorado.** Performed original, copy cataloging and classification of library materials (English and Spanish) using standard library protocols; completed original descriptive cataloging and subject analysis; enhanced brief catalog and authority records in III.
- 1997-1999** **Development Officer, McREL International, Aurora, Colorado.** Served as senior member of corporate management team in strategic planning, development of proposals and contracts, implementation, and evaluation of new services, products, and programs for educational agencies. Provided creative leadership to corporate committees to solicit ideas, identify goals and objectives, plan, develop, present, and evaluate professional development opportunities.
- 1995-1997** **Education Specialist, Education Service Center, Region One, Edinburg, Texas.** Served as member of Administrative Cabinet team in strategic planning, development of proposals and contracts, implementation, and evaluation of telecommunications capabilities, services, products, and programs for 40 school districts serving 283,000 students in 7 counties. Provided creative leadership to regional and state committees to solicit ideas, identify strategic goals and objectives, plan, develop, present, and evaluate funding opportunities and professional development for 400 librarians.

- 1993-1996** **Assistant Professor of Library Science, Sam Houston State University, Huntsville, Texas.** Served as a faculty member teaching 400 graduate students in technical services (cataloging, bibliographic control, classification), automation, and networking. Participated in distance education program and coordinated annual conference. Conducted university and Texas Library Association-funded field research focused on library collection development and academic achievement.
- 1992-1993** **Head Librarian, Rocky Mountain College of Art & Design, Denver, Colorado.** Responsible for the daily operation, selection and acquisition of materials, formulation of policies for library operations, media center, and photography/slides archives. Designed and implemented library automation and delivery of electronic resources to college community.
- 1981-1985** **Development Officer, PRLC, Inc., Pittsburgh, Pennsylvania.** Served as senior member of corporate management team in strategic planning, development of proposals and contracts, implementation, and evaluation of new services, products, and programs for 100 institutional member organizations. Coordinated the development of proposals and contracts totaling \$4,000,000 annually. Provided creative leadership to corporate committees to solicit ideas, identify goals and objectives, plan, develop, present, and evaluate professional development opportunities.
- 1981** **Director of Library Development, Pennsylvania Department of Education, Harrisburg, Pennsylvania.** Responsible for statewide development, technical assistance, professional development, resource sharing, children's services, institutional library services, networking, and state aid program for all libraries throughout the Commonwealth. Functioned as liaison to Governor's Advisory Council, LSCA Advisory Council, District Administrators, private colleges, universities, consortia managers, and network directors. Supervised \$14,000,000 formula-based state aid program and \$3,000,000 grant awards to individual libraries, consortia, and networks.
- 1978-1981** **Assistant Director, Southern Tier Library System, Corning, New York.** Coordinated operation of system-wide programs (technical assistance, professional development, resource sharing, technical services, outreach) to 40 public libraries in 5 counties serving 500,000 residents. Solicited ideas, identified goals, sponsored, and evaluated professional development opportunities and technical assistance sessions.
- 1976-1978** **Division Librarian for Technical Services, Corpus Christi Public Libraries, Corpus Christi, Texas.** Provided leadership in acquisitions, cataloging, serials control, and processing for main library and 4 branches serving 250,000 residents. Participated as senior member of library management team. Compiled and prepared technical evaluations, reports, and statistical analyses of Division operations to measure the achievement and cost of annual goals, objectives, and staff performance.
- 1975-1976** **System Coordinator, San Antonio Major Resource Center, San Antonio, Texas.** Served as senior member of the management team for District X Office, charged to provide technical assistance, resource sharing, media services, and professional development to librarians and staff representing 30 public library jurisdictions in 21 counties serving 1,500,000 residents. Functioned as liaison to System Director, staff, and members of governing bodies with the System Board of Directors and the Texas State Library and Historical Commission. Prepared LSCA grant applications and monitored awards totaling \$1,100,000 annually.
- 1973-1975** **Bilingual Branch Librarian, San Antonio Public Library, San Antonio, Texas.** Worked as librarian providing reference, information, and readers' advisory services in branch serving 50,000 Spanish-speaking residents in southwest San Antonio. Participated in collection development and resource acquisition activities, specializing in children's work, Spanish language resources, and multicultural studies.

- 1972-1973** **Librarian, Holding Institute, Laredo, Texas.** Worked as high school librarian serving 500 boarding students in Spanish-speaking environment of private school. Provided reference, research assistance, and library instruction to students and 35 faculty members.
- 1966-1971** **Rockford Public Library, Rockford, Illinois.** Worked in branches as part-time as a Library Assistant, Clerk, and Page in city library serving 150,000 residents.

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- Rueda, André. *Vengo a Salvar a España: Biografía de Un Franco Desconocido*. Madrid: Nowtilus (Investigación Abierta), 2005. photogs., bibliog. 84-9763-202-8, paper, \$23.95 [Críticas, March 2006]
- Becerra, Ángela. *El Penúltimo Sueño*. 1st ed. Barcelona: Planeta, 2005. 84-08-05795-2, \$25.95. [Críticas, January 2006]
- Aguilar Camín, Héctor. *La Conspiración de la Fortuna*. 1st ed. México: Planeta, 2005. 970-37-0368-2, \$19.95 [Críticas, October 2005]
- México en Sus Libros*. Enrique Florescano with Pablo Mijangos, editors & compilers. 1st ed. México, D.F.: Taurus Aguilar, 2004. 968-19-0783-3, \$16.95 [Críticas, September 2005]
- Historia Económica de México*. Coordinator, Enrique Semo. México: Universidad Nacional Autónoma de México, Editorial Oceano de México, 2004. 13 vols. 970-32-0805+3 (obra completa), \$9.25 each [Críticas, August 2005]
- Czarnowsky, Christyne A. and Michael H. Williams. *Managing Your Wired Workforce: A Practical Guide*. Denver, Colo.: Bradford Pub., 2003. 1-883726-79-4, \$24.95 [Colorado Libraries, 2004]
- Abraham Lincoln*. Colección Grandes Biografías. Madrid: Edimat Libros, 2003. 84-8403-858-0, €4.95 [Críticas, 2004]
- Alponte, Juan María. *Colón: el Hombre, el Navegante, la Leyenda*. México, D.F.: Aguilar, 2003. 968-19-1260-8, \$16.95 [Críticas, 2004]
- Olcese Salvatecci, Alfieri. *Cómo Estudiar con Éxito: Técnicas y Hábitos Para Aprender Mejor*. México, D.F.: Alfaomega Grupo Editor, 2002. 970-15-0764-9 [Críticas, 2003]
- Mujeres Como Islas: Antología de Narradoras Cubanas, Dominicanas, Puertorriqueñas*. Edición: Olga Marta Pérez, Thelma Jiménez, Andrés Blanco D., eds. Santo Domingo, República Dominicana: Ediciones Ferilibro, 2002. 959-209-419-5 [Críticas, 2003]
- Tibol, Raquel. *Los Muros de Diego Rivera: Universidad Autónoma Chapingo*. México, D.F.: Editorial RM, Universidad Autónoma Chapingo, 2002. 968-5208-08-5 [Críticas, 2003]
- Lindsay-Poland, John. *Emperors in the Jungle: the Hidden History of the U.S. in Panama*. Durham, N.C.: Duke University Press, 2003. 0-8223-3098-9, \$18.95 [Críticas, 2003]
- Kaplan, Allison G. and Ann Marlowe Riedling. *Catalog It! A Guide to Cataloging School Library Materials*. Worthington, Ohio: Linworth Pub., 2002. 1-58683-014-7, \$44.95 [Colorado Libraries, 2002]

- Bardach, Ann Louise. *Cuba Confidential: Love and Vengeance in Miami and Havana*. New York: Random, 2002. 0-375-50489-3, \$25.95 [*Library Journal*, 2002]
- Swan, James. *Fundraising for Libraries: 25 Proven Ways to Get More Money for Your Library*. New York: Neal Schuman, 2002. 1-55570-433-6, \$69.95 [*Colorado Libraries*, 2002]
- Puig de Lange, Victoria. *Sol Con Agua*. Nashville, Tenn.: Editorial Vistazo/Ediciones Reio Negro, 2002. 0-9724506-0-2, \$17.75 [*Críticas*, 2002]
- The Encyclopedia of Latin American Politics*. Edited by Diana Kapiszewski; assistant editor, Alexander Kazan. Westport, Conn.: Oryx Press, 2002. 1-57356-306-4, \$74.95 [*Library Journal*, 2002]
- Vargas Lizano, Isabel. *Y Si Quieres Saber de Mi Pasado*. Con la colaboración de J.C. Vales. Madrid: Santillana Ediciones Generales, S.L., 2002. 84-03-09278-4, \$18.95 [*Críticas*, 2002]
- Ruy Sánchez, Alberto. *Los Jardines Secretos de Mogador: Voces de Tierra*. México, D.F.: Alfaguara, S.A., 2001. 968-19-0879-1, \$16.95 [*Críticas*, 2002]
- Chávez, Ricardo and Celso Santajuliana. *El Final de las Nubes*. Barcelona: RBA Libros, S.A., 2001. 84-7901-760-0, \$11.95 [*Críticas*, 2002]
- The Power of Language / El Poder de la Palabra: Selected Papers from the Second REFORMA National Conference*. Edited by Lillian Castillo-Speed and the REFORMA National Conference Publications Committee. Englewood, Colo.: Libraries Unlimited, 2001. 1-563089459, \$35.00 [*Colorado Libraries*, 2001]
- Martínez, Rubén. *Crossing Over: A Mexican Family on the Migrant Trail*. Metropolitan: Holt, 2001. 0-8050-4908-8, \$26.00 [*Library Journal*, 2001]
- Guevara, Ernesto "Che." *The African Dream: the Diaries of the Revolutionary War in the Congo*. Translated from the Spanish by Patrick Camiller. With an introduction by Richard Gott and a foreword by Aleida Guevara March. New York: Grove Press, 2001. 0-8021-3834-9, \$13.00 [*Library Journal*, 2001]
- Cooper, Gail and Garry Cooper. *New Virtual Field Trips*. Englewood, Colo.: Libraries Unlimited, 2001. 1-56308-887-8, \$27.50 [*Colorado Libraries*, 2001]

NATIONAL SERVICE & PROFESSIONAL AFFILIATIONS

American Library Association

Association for Library Collections & Technical Services
Cataloging, Classification, and Metadata Section
ALCTS Editorial Board, Member, 2015-
Committee on Cataloging: Description and Access, Member, 2008-2012
Test Site for RDA, Manager, 2009-2011
Nominating Committee, Member, 2007-2008
Committee for Education and Training of Catalogers, Chair, 2006-2007, Member, 2003-2007
Competencies & Education for a Career in Cataloging Interest Group, Chair, 2010-2012; Member, 2010-
President's Program Committee, 2015-2016
Education Committee, Member, 2005-2007
Task Force on Competencies and Education for a Career in Cataloging, Chair, 2007-2009
2007 Annual Meeting Pre-conference, "What They Don't Teach in Library School: Competencies,
Education and Employer Expectations for a Career in Cataloging," Steering Committee Chair
Fundraising Committee, Member, 2004-2006
Office of Diversity
Committee on Diversity, Chair, 2010-2011
Diversity Research Advisory Committee, Member, 2009-2010
Spectrum Scholar Mentor, 2009
Diversity Grants Review Committee, Member, 2007, 2010, 2012
Office of Statistics and Research
Research and Statistics Committee, Member, 2005-2007; Intern, 2003-2005
Library Research Round Table
Board of Directors, Member At-Large, 2009-2012
Member, 2003-
Office of Accreditation
Accreditation Panel Member (training completed 2004)
Accreditation Review Panel Member (training completed 2004)

REFORMA

National Board of Directors, 2005-2013
National Fundraising Chair, 2005-2013
National Recruiting and Mentoring Committee, 2008-2010
Colorado Chapter, Secretary, 2004-2005
Colorado Chapter Liaison to National Board of Directors, 2004-2013

Online Audiovisual Catalogers Association (OLAC)

American Association of Law Libraries (AALL)

Colorado Association of Law Librarians (CoALL)

Association for Library and Information Science Education (ALISE)

University of Denver ALISE Representative, 2003-2008; 2010-2011
Membership Advisory Committee, 2007-2010
Technical Services Education Special Interest Group, 2003-
Garfield Doctoral Dissertation Award Reviewer, 2012
Garfield Doctoral Dissertation Scholarship Reviewer, 2014

American Association of University Professors (AAUP), 2006-

American Grant Writers Association, 2014-

Grant Professionals Institute, 2016-

National Grants Management Association, 2014-

Grant Reviewer (National and Regional Team Leader), U.S. Department of Education, 1998-
Grant Reviewer, Broadband Technologies Opportunity Program, U.S. Department of Commerce, 2009

Grant Reviewer, Institute of Museum and Library Services, 1998-2000
Grant Reviewer, Colorado Department of Education, 2014-
Grant Reviewer, Colorado State Library, 1998-
Grant Reviewer, American Association of Community Colleges *Working Connections* program, 1999
Peer Reviewer, *Journal for Library and Information Science Education*, 2005-
Peer Reviewer, *Journal of Library Metadata*, 2009
Peer Reviewer, *International Journal of Library and Information Science*, 2011
Regular Columnist, *The Bottom Line*, 2013-2016
Book Reviewer, *Library Journal*, 2001
Book Reviewer, *Críticas*, 2002-2009
Book Reviewer, *Colorado Libraries*, 2000-2012

REGIONAL SERVICE & PROFESSIONAL AFFILIATIONS

Mountain Plains Library Association

Professional Development Grants Committee, Member, 2005-2006
Professional Development Policy and Guidelines Sub-committee Chair, 2006

Colorado Association of Libraries

"Student Voices" Column Editor, *Colorado Libraries*, 2005-2006
Conference Planning Committee, Member, 2002
Technical Services and Automation Division, Chair, 2002-2003; Member, 2000-
Academic Libraries Division, Peer Review Conference Papers Committee, Member, 2007-2009
Education Committee, Member, 1988-1993
Diverse Populations Committee, Member, 2009-2013

SERVICE TO THE UNIVERSITY OF DENVER

Center for Teaching and Learning Faculty Advisory Board, 2007-2008; 2010-2012
Center for Community Engagement and Service Learning Advisory Board, 2007-2012
Faculty Senate
Executive Committee, 2008-2013
Nominations, Rules & Credentials Committee, Chair, 2008-2013; Member 2007-2013
Appointment, Promotion, and Tenure Revision Committee, 2010-2012
Grievance Policy Committee Member, 2007-2010
Law Library Director Search Committee Chair, 2012-2013
PROF Grant Review, College Representative to the University Review Team, 2006, 2008
Project Homeless Connect Evaluations, Principal Investigator, 2006-2009
University Technology Council, 2007-2009
University of Denver Hyde Interviews for Incoming Freshmen, 2003-2012

SERVICE TO THE MORGRIDGE COLLEGE OF EDUCATION

Appointment, Tenure & Review Committee
Member, voting, 2003-2005; 2007- 2009
Chair, Clinical Faculty Promotion & Tenure Policy Subcommittee, 2008-2009
Member, Community Engagement Subcommittee, 2007-2009
Member, Tenure Review Panel, 2003
Advancement and Alumni Relations Committee, Chair, 2003-2007; Member, 2002-2007
College Building Committee Member, 2004-2010
College of Education Student Association, Faculty Advisor, 2004-2007; 2009-2010
Faculty Senator, 2007-2013
Research and Scholarship Committee, Chair, 2008-2009; Member, 2002-2003, 2008-2009
Research and Grant Mentoring Committee, Chair, 2009-2010
Research Task Force Member, 2010-2012
Search Committee Member, Assistant Professor for Curriculum & Instruction, 2010-2011
Workload Task Force Member, 2010-2011

SERVICE TO THE LIBRARY & INFORMATION SCIENCE PROGRAM

Library and Information Science Student and Alumni Association, Faculty Advisor, 2002-2008
ALA Student Chapter, Faculty Advisor, 2005-2008
Beta Phi Mu Phi Chapter, Faculty Advisor, 2004-2014
Steering Committee Member, Accreditation by the American Library Association, 2001-2004
Search Committee Member, Associate Professor for LIS, 2006
Search Committee Chair, Assistant Professors for LIS, 2003, 2005, 2006, 2007
Search Committee Ex-Officio Member, Director for LIS, 2004

SERVICE TO SAM HOUSTON STATE UNIVERSITY

Rio Roundup: South Texas Literature Conference, Conference Coordinator, 1993
External Relations, Fund Raising, Grants Committee, Chair, 1993-1995
Advisory Council Committee, Chair, 1993-1995
Students, Admissions, and Advisement Committee, Chair, 1994
Institutional Effectiveness Committee, Member, 1993-1995

SERVICE TO THE COLLEGE OF EDUCATION AND APPLIED SCIENCE

Faculty Affairs Committee, Member, 1993-1995
Curriculum Committee, Member, 1993-1995
Continuing Education Committee, Member, 1993-1995

SERVICE TO THE COMMUNITY

Denver/Boulder Games 2022, Board of Directors, Secretary-Treasurer, 2015-
United Way Campaign Committee, College of Education, 2006
Arapahoe County, Election Judge for the County Clerk and Recorder, 2000-2005
Arthritis Foundation, Rocky Mountain Chapter, Certified Educator & Trainer, 1999-2008
Bonfils Blood Center, Silver Level Donor, 2000-
Denver Museum of Natural History, Docent, 1992
Tech Prep of the Lower Rio Grande Valley, Inc. (Harlingen, Texas) Board of Directors, 1995-1997
Executive Committee, 1996-1997; Chair, Development Committee, 1995-1997; Chair, Fiscal Agency
Committee, 1995-1996; Chair, Colleges and Universities Committee, 1996-1997
Gilpin County (Colorado) Public Library Board of Trustees, 1986-1989; Vice President, 1987-1989
City of Central (Colorado) Economic Development Committee, 1987-1989
Columbine Family Health Centers, Inc. (Nederland and Black Hawk, Colorado) Board of Directors, 1988-1989

CERTIFICATION

Permanent Public Librarian Certificate - Pennsylvania, New York, Texas
Westlaw Expert Witness, 2008-
Certified Grant Writer®, 2016-

AWARDS AND HONORS

Advanced Practitioner for Service Learning and Community Engagement, University of Denver, 2011
Platinum Star Alumnae, College of Information, Library Science & Technologies, University of North Texas, 2009
Commendation for Integration of Technologies in Teaching & Learning Environment, University of Denver, 2006
Outstanding Adjunct Faculty Member Award, College of Education, University of Denver, 2002
Beta Phi Mu, Pi, University of Pittsburgh, 1985
Alpha Lambda Sigma, University of North Texas, 1972

Albert Nelson Marquis Lifetime Achievement Award, Who's Who in America; Who's Who in American Women; Who's Who of Women Executives; Dictionary of International Biography; Who's Who in the East; Who's Who in the South and Southwest; Who's Who in the World; Who's Who of Online Professionals; Who's Who in Library and Information Science; 2,000 Notable Women; Who's Who of Emerging Leaders; Who's Who in Professional and Executive Women; Who's Who in American Education; International Who's Who of Professional and Business Women; International Leaders in Achievement; International Educator of the Year; Who's Who in Finance and Industry; Who's Who in Finance and Business

Invited International and National Conference Presentations

Hall-Ellis, Sylvia D. *Invest in Me -- I'm Your Future: Succession Planning for Libraries*. Keynote presentation delivered at the ALCTS President's Symposium, Boston, Mass., January 8, 2016.

Seidel, Kent E. and Sylvia D. Hall-Ellis. *Making Grants Work for You: Strategies for Doctoral Students and Early Career Scholars*. Presentation delivered at the University Council for Educational Administration, Early Career Scholars Session, Indianapolis, Ind., November 9, 2013.

Hall-Ellis, Sylvia D. *So You Want to be a Manager; Leadership Skills and Competencies for Technical Services Managers and Administrators*. Presentation delivered at the 138th Annual Conference, American Library Association, Chicago, Ill., June 29, 2013.

Seidel, Kent E., Karen S. Riley, Lyndsay Agans, Susan Korach, and Sylvia D. Hall-Ellis. *Making Grants Work for You (Instead of Just Working for Grants)*. A panel discussion delivered at the University Council for Educational Administration, Early Career Scholars Session, Denver, Colo., November 17, 2012.

Hall-Ellis, Sylvia D. *After the Great TS Reorganization: The Westminster Law Library*. Presentation delivered at the 137th Annual Conference, American Library Association, Anaheim, Calif., June 23, 2012.

Hall-Ellis, Sylvia D. *Conversations with Catalogers in the 21st Century*. A panel discussion sponsored by the ALCTS Competencies for a Career in Cataloging Interest Group, delivered at the 137th Annual Conference, American Library Association, Anaheim, Calif., June 22, 2012.

Hall-Ellis, Sylvia D., moderator. *Mid-Career Leaders Program*. A panel discussion sponsored by the ALA Committee on Diversity delivered at the 136th Annual Conference, American Library Association, New Orleans, La., June 26, 2011.

Hall-Ellis, Sylvia D., moderator. *Diversity Town Hall*. A community conversation sponsored by the ALA Committee on Diversity delivered at the 136th Annual Conference, American Library Association, New Orleans, La., June 24, 2011.

LaBarre, Kathryn, Sylvia D. Hall-Ellis, Karen Anderson, Rick Hasenyager, Christopher Cronin, and Penny Baker. *Briefings from RDA Test Participants*. A panel discussion delivered at the Midwinter Conference, American Library Association, San Diego, Calif., January 7, 2011.

Miksa, Shawne, Marjorie Bloss, and Sylvia D. Hall-Ellis. *Educating the Next Generation of Catalogers: Teaching RDA*. A panel discussion delivered at the 97th Annual Conference, Association for Library and Information Science Education, San Diego, Calif., January 7, 2011.

Hall-Ellis, Sylvia D., Robert Maxwell, John Hostage, and George Prager. *RDA Panel: What Cataloging Managers Need to Know*. Presentation delivered at the 103rd Annual Conference, American Association of Law Librarians, Denver, Colo., July 12, 2010.

Hall-Ellis, Sylvia D. and Stacey L. Bowers. *Catalogers in the RDA Environment: Skill Sets, Expectations and Challenges*. Presentation delivered at the 103rd Annual Conference, American Association of Law Librarians, Denver, Colo., July 11, 2010.

Hall-Ellis, Sylvia D. *Comfortable in Your Cataloging and Metadata Specialist Skin? Or, So You Want to Hire a Cataloger*. Presentation delivered to the ALCTS Research Group at the 134th Annual Conference, American Library Association, Chicago, Ill., July 11, 2009.

Perez, Megan, Sylvia D. Hall-Ellis, and Denise Anthony. *From Novice to Expert: Collaboration for Succession Planning*. A "hot topic" presentation delivered at the 14th ACRL Conference, Seattle, Wash., March 13, 2009.

- Hall-Ellis, Sylvia D. *Cataloging in the RDA Environment: Skill Sets, Expectations and Challenges*. Presentation delivered to the ALCTS Research and Publications Committee at the Midwinter Conference, American Library Association, Denver, Colo., January 24, 2009.
- Hall-Ellis, Sylvia D. *LIS Cataloging Education for the 21st Century: Expectations and Challenges*. A panel discussion held at the 95th Annual Conference, Association for Library and Information Science Education, Denver, Colo., January 23, 2009.
- Chu, Clara, Sylvia D. Hall-Ellis, and Mark Winston. *The Doctoral Degree & Building a Career*. A panel discussion delivered at the ALA Office of Diversity Spectrum Doctoral Fellows E.J. Josey Leadership Institute, Midwinter Conference, American Library Association, Denver, Colo., January 20, 2009.
- Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Fundamentals of Cataloging Course: An Overview of the ALCTS Online Course*. Presentation delivered to the ALCTS Big Heads Group, 133rd Annual Conference, American Library Association, Anaheim, Calif., June 30, 2008.
- Hall-Ellis, Sylvia D. *Employers' Expectations for Technical Services Librarians: What We Don't Know*. Presentation delivered to the ALCTS Research and Publications Committee Program, 133rd Annual Conference, American Library Association, Anaheim, Calif., June 28, 2008.
- Hall-Ellis, Sylvia D., Virginia R. Maloney, and Mary Stansbury. *Institutional Responses to Engaged Scholarship: The Carnegie Foundation Engaged University Classification at Two Universities*. Presentation delivered to the 94th Annual Conference, Association for Library and Information Science Education, Philadelphia, Pa., January 11, 2008.
- Hall-Ellis, Sylvia D. *Puzzles, Problems, and Predicaments*. Presentation delivered to the ALCTS Research Discussion Group, 132nd Annual Conference, American Library Association, Washington, D.C., June 23, 2007.
- Hall-Ellis, Sylvia D. *Cataloging Education: A New Emphasis for the Library and Information Science Curriculum*. Presentation delivered to the ALCTS Pre-conference, 132nd Annual Conference, American Library Association, Washington, D.C., June 22, 2007. <http://www.loc.gov/catdir/cpsocareercat.html>
- Ellett, Jr., Robert O. and Sylvia D. Hall-Ellis. *Copy Cataloging Done Smarter*. Presentation delivered to the International Conference on Interdisciplinary Information Sciences and Technologies (InSciT2006), October 25-28, 2006.
- Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Cooperative Cataloging: Challenges and Opportunities for Defense Libraries*. Presentation delivered to the 1st Annual Conference of Defense Libraries, Spanish Ministry of Defense, Madrid, Spain, July 7, 2006.
- Hall-Ellis, Sylvia D. *Cataloger Competencies: Do the Employers Require What the Professors Teach?* Presentation delivered to the ALCTS CCS Heads of Cataloging Discussion Group, 131st Annual Conference, American Library Association, New Orleans, La., June 26, 2006.
- Grealy, Deborah S. and Sylvia D. Hall-Ellis. *From Research to Practice: The Scholarship of Teaching and Learning in LIS Education*. Presentation delivered to the at the 92nd Annual Conference, Association for Library and Information Science Education, San Antonio, Tex., January 18, 2006.
- Hall-Ellis, Sylvia D. *Employers' Expectations for Entry-Level Catalogers: What Position Announcement Data Indicate*. Research paper delivered to the Technical Services Special Interests Group, 91st Annual Conference, Association for Library and Information Science Education, Boston, Mass., January 12, 2005.
<http://dlist.sir.arizona.edu/>

Hall-Ellis, Sylvia D. *Common Errors in MARC Records Prepared by LIS Students: What Does It Mean?* Research paper delivered to the ALCTS CCS Cataloging Norms Discussion Group, Mid-Winter Conference, 90th American Library Association, San Diego, Calif., January 10, 2004.

Hall-Ellis, Sylvia D. *Visual Arts as Foundation for Successful Library Automation: The Rocky Mountain College of Art & Design Experience*. Paper delivered at the 6th Annual Conference of Higher Education, Charleston, S. C., 1993.

Hall, Sylvia D. *Design Elements for Bibliographic Databases: An Overview*. Paper delivered at the 14th Online National Conference, New York, 1983.

Invited Regional Conference Presentations

Hall-Ellis, Sylvia D., Hudson, Christopher D., Brittany Cronin, and Kathryn Michaels. "The Colorado Law Project: Meeting the Public's Need for Legal Information." Panel discussion delivered at the Mountain Plains Library Association Conference, Billings, Mont., April 9, 2011.

Grealy, Deborah S. and Sylvia D. Hall-Ellis. *Education for Information Professionals in New Mexico: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the New Mexico Library Education Summit, Las Vegas, N.M., September 26, 2005.

Hall-Ellis, Sylvia D. *Public Library-School Library Partnerships*. Presentation delivered at the 3rd Annual Colorado Association of Libraries Conference with the Mountain Plains Library Association, Denver, Colo., October 22, 2004.

Hall-Ellis, Sylvia D. *Learn All You Can – Educational Partnership Opportunities for the Lewis and Clark Bicentennial Commemoration*. Paper delivered at the 3rd Annual Lewis and Clark Bicentennial Council National Planning Conference, Bismarck, N.D., April 26, 1998.

Invited State Conference Presentations

Grealy, Deborah S. and Sylvia D. Hall-Ellis. *Academic Library Leadership Changes: Using Succession Planning and Mentoring*. Presentation delivered at the Minnesota Library Education Conference, St. Cloud, Minn., October 10, 2013.

Hall-Ellis, Sylvia D., Merrie Valliant, and Melissa Powell. *RDA: What Is It and What Do You Need To Do With It At Your Library?* Presentation delivered at the Colorado Library Consortium Spring Conference, Ft. Morgan, Colo., April 26, 2013.

Hall-Ellis, Sylvia D. *Service Learning and the Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 4th LEADS Scholars Orientation, Denver, Colo., August 5, 2009.

Hall-Ellis, Sylvia D. *Service Learning: Enhancement to Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 3rd LEADS Scholars Orientation, Denver, Colo., June 2008.

Hall-Ellis, Sylvia D. *Law Librarianship: A Community Conversation*. Sponsored by the Colorado Association of Law Libraries. Paper delivered at the Colorado Supreme Court Library, Denver, Colo., May 14, 2008.

Hall-Ellis, Sylvia D. *Opportunities and Challenges in Law Librarianship: A Community Conversation*. Presentation delivered at the Sturm College of Law, Denver, Colo., November 7, 2007.

Hall-Ellis, Sylvia D. *Grant Writing Resources for Nursing Professionals*. Presentation delivered at the Presbyterian / St. Luke's Health One Medical Center 1st Annual Research Symposium, Denver, Colo., October 17, 2007.

- Hall-Ellis, Sylvia D. *Project Homeless Connect 4 Event Evaluation – Insights and Lessons Learned*. Presentation delivered at the Homelessness Research Symposium: What is DU Doing about Homelessness in Denver, Denver, Colo., September 14, 2007.
- Hall-Ellis, Sylvia D. *Service Learning and the Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 2nd LEADS Scholars Orientation, Denver, Colo., August 10, 2007.
- Hall-Ellis, Sylvia D. *Education for Information Professionals in a Digital Environment: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 15th Spring Mountains and Plains Parapros Conference, Denver, Colo., February 24, 2007.
- Hall-Ellis, Sylvia D. *Public Library Service to Spanish-Speaking and Latino Residents in Denver: A Case Study*. Presentation delivered at the 4th Annual Colorado Association of Libraries Conference, Denver, Colo., November 10, 2005.
- Hall-Ellis, Sylvia D. *Education for Information Professionals in a Digital Environment: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 14th Annual Mountains and Plains Parapros Conference, Aurora, Colo., July 29, 2005.
- Hall-Ellis, Sylvia D. *Educational Opportunities: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 13th Annual Mountains and Plains Parapros Conference, Centennial, Colo., August 6, 2004.
- Hall-Ellis, Sylvia D. *Library Education & Training: Focus on the West: An LIS Faculty Member's Personal Response*. Presentation delivered at the 1st Annual Colorado Association of Libraries Conference, Keystone, Colo., October 18, 2002.
- Hall-Ellis, Sylvia D. *Grant Writing for School Librarians*. Presentation delivered at the 2002 Annual Colorado Education Media Association Conference, Colorado Springs, Colo., February 15, 2002.
- Hall-Ellis, Sylvia D. *Grants – Opportunities for the Future*. Paper delivered at the Southeast Regional Accountability Annual Conference, Lamar, Colo., November 12, 1998.
- Hall-Ellis, Sylvia D. *The Texas Library Connection and Interlibrary Loan: An Experiment in Resource Sharing*. Paper delivered at the Texas Computer Educators' Association Annual Conference, Austin, Tex., February 6, 1997.
- Hall-Ellis, Sylvia D. *Finding Grant Sources on the Internet: A Guide for Librarians*. Paper delivered at the 2nd Annual Institute for School Library Personnel, Pharr-San Juan-Alamo North High School, Pharr, Tex., July 29, 1996.
- Hall-Ellis, Sylvia D. *Mathematical and Logical Thinking: A Critical Intelligence*. Paper delivered at the 3rd Annual Paraprofessional Conference at the University of Texas - Pan American, Edinburg, Tex., March 8, 1996.
- Hall-Ellis, Sylvia D. *Cataloging Trends and Issues: Update Session*. Paper delivered at the 1st Annual Institute for School Library Personnel, South Texas Community College, McAllen, Tex., July 19, 1995.
- Hall-Ellis, Sylvia D. *Grant Writing: Tips and Encouragement for School Librarians*. Paper delivered at the 1st Annual Institute for School Library Personnel, South Texas Community College, McAllen, Tex., July 18 and 19, 1995.
- Hall-Ellis, Sylvia D. *How to Become an Expert Grant Writer*. Paper delivered at the 3rd Annual High School Principals' Academy, South Padre Island, Port Isabel, Tex., June 19, 1995.

Hall-Ellis, Sylvia D. *Texas Library Study: Results from Regions I and II*. Paper delivered at the 3rd Annual Technology Conference, Texas A&M University, College Station, Tex., November 18, 1994.

Hall-Ellis, Sylvia D. *Academic Achievement and Middle School Students*. Paper delivered at the 8th Annual Young Adult Conference, Sam Houston State University, Huntsville, Tex., November 5, 1994.

Hall-Ellis, Sylvia D. *Multimedia Resources for Library Leaders*. Paper delivered at the Institute for Librarians in A Multicultural Environment, Sam Houston State University, Huntsville, Tex., June 10, 1994.

Hall-Ellis, Sylvia D. *Finding the Resource: Empowering the User, or, the Case for Curriculum Based Subject Access to Learning Resource Center Collections*. Paper delivered at the 81st Annual Texas Library Association Conference, Corpus Christi, Tex., April 12-16, 1994.

Hall-Ellis, Sylvia D. and William H. Pichette. *Sam Houston State University Makes Use of OCLC/AMIGOS Collection Analysis CD*. Paper delivered at the 81st Annual Texas Library Association Conference, Corpus Christi, Tex., April 12-16, 1994.

Hall, Sylvia D. *Funding and Library Development in Pennsylvania: A Symbiotic Relationship*. Paper delivered at the Annual Graduate Student Colloquia, University of Pittsburgh, School of Library and Information Science, 1982.

Hall, Sylvia D. *Leadership for Public Library Trustees*. Paper delivered for the Trustees Division, Pennsylvania Library Association Annual Conference, Lancaster, Penn., 1981.

Seminar and Professional Development Presentations

Taylor, Meredith, and Sylvia D. Hall-Ellis. *Talent Management and Succession Planning*. ALCTS eForum, held March 22, 2017.

Hirsh, Sandra, Heather O'Brien, Michelle Holschuh Simmons, Michael Krasulski, and Sylvia D. Hall-Ellis. *Information Services Today: An Introduction. Part 3: Information Services: Roles in the Digital Age*. Rowan and Littlefield in partnership with Library Journal webinar, recorded February 5, 2015.

Hall-Ellis, Sylvia D. and Jennifer Sweda. *Copy Cataloging in an RDA Environment*. ALCTS eForum, held May 14 and 15, 2013.

Hall-Ellis, Sylvia D. *Law Librarianship: A Community Conversation*. Sponsored by the Colorado Association of Law Libraries, presented at the Colorado Supreme Court Library, Denver, Colo., May 14, 2008.

Hall-Ellis, Sylvia D. and Beatrice Z. Gerrish. *Reading and Libraries: Recent Research in Reading*. Presentation at the Ricks Center for Gifted Education, Denver, Colo., March 4, 2008.

Hall-Ellis, Sylvia D. *Cataloger Competencies: Do the Employers Require What the Professors Teach?* Presentation for the School of Library and Information Science, San José State University, February 12, 2008.

Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Cooperative Cataloging: Rules, Tools, and Conventions for Building a Multi-institutional Catalog*. Sponsored for the Spanish Ministry of Defense, Madrid, Spain, July 10, 2006.

Hall-Ellis, Sylvia D. *Cash for Kids: Grant Writing Opportunities for Youth Services Librarians*. Sponsored by the Colorado Young Adult Librarians; presented at Bemis Memorial Library, Littleton, Colo., November 13, 2002.

Hall-Ellis, Sylvia D. *MARC Records and Authority Control: Planning for Bibliographic Database Migration*. Sponsored and held at the Douglas County Public Library, Castle Rock, Colo., May 28, 2002.

Hall-Ellis, Sylvia D. *Grant Writing: A Refresher for Librarians*. Sponsored by Library and Information Science Program, College of Education, University of Denver; presented at University Center at Chaparral, August 12, 2000.

Hall-Ellis, Sylvia D. *Shaking the Money Tree – Basic Grant Writing for Colorado Educators*. Sponsored by the Office of Educational Telecommunications of the Colorado Department of Education.
Pikes Peak Community College, Colorado Springs, Colo., November 16, 1998.
Pueblo School District 60, Pueblo, Colo., November 12, 1998.
University of Northern Colorado, Greeley, Colo., November 10, 1998.
United Technology Educational Partnership, Grand Junction, Colo., November 9, 1998.

Hall-Ellis, Sylvia D. *Cataloging Multimedia, Kits, Globes and Map Materials in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., April 24, 1997 and December 12, 1996.

Hall-Ellis, Sylvia D. *New Standards for School Library Media Centers*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., April 15, 1997.

Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21st Century: Visions for the Future*. Sponsored and hosted by Pharr-San Juan-Alamo Independent School District, Pharr, Tex., April 4, 1997.

Hall-Ellis, Sylvia D. *Cataloging Sound Recordings and Audio Materials in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., March 20, 1997 and November 21, 1996.

Hall-Ellis, Sylvia D. *Evaluating and Selecting CD-ROMs for School Library Media Collections*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., March 18, 1997.

Hall-Ellis, Sylvia D. *Cataloging Audiovisual Materials in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., February 27, 1997, November 7, 1996 and October 24, 1996.

Hall-Ellis, Sylvia D. *Introduction to Dialog: Basic Searching Strategies*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., February 14, 1997.

Hall-Ellis, Sylvia D. *Cataloging Books in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., January 30, 1997, October 10, 1996, September 26, 1996 and August 8, 1996.

Hall-Ellis, Sylvia D. *Advanced Internet Searching Techniques for Librarians*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., January 21, 1997.

Hall-Ellis, Sylvia D. *Texas Library Connection Full-Text Searching*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., December 13, 1996 and October 25, 1996.

Hall-Ellis, Sylvia D. *Developing Evaluation Strategies for Grants and Proposals*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., December 10, 1996.

Hall-Ellis, Sylvia D. *Developing Needs Assessment for Grants and Proposals*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., November 12, 1996.

Hall-Ellis, Sylvia D. *Texas Library Connection Union Catalog Searching*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., November 8, 1996 and September 6, 1996.

Hall-Ellis, Sylvia D. *Grant Resources on the Internet*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., October 23, 1996.

- Hall-Ellis, Sylvia D. *Preparing a Response to the Telecommunications Infrastructure Fund Board: Needs Assessment, Professional Development Framework, and Evaluation Strategies*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., October 16, 1996.
- Hall-Ellis, Sylvia D. *Texas Library Connection: Building the Districtwide Bibliographic Database*. Sponsored and hosted by Mercedes Independent School District, Mercedes, Tex., September 13, 1996 and August 8, 1996. Sponsored and hosted by Los Fresnos Consolidated Independent School District, Los Fresnos, Tex., August 12, 1996.
- Hall-Ellis, Sylvia D. *School-to-Work and Special Education: An Inclusive Partnership for Success*. Sponsored and hosted by the Office of Special Education, Region One Education Service Center, Edinburg, Tex., September 11, 1996.
- Hall-Ellis, Sylvia D. *Telecommunications Infrastructure Fund Board: An Overview of Funding for Secondary Schools*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., August 31, 1996.
- Hall-Ellis, Sylvia D. *Cataloging Books, Multimedia, and Realia in USMARC*. Sponsored and hosted by Edinburg Consolidated Independent School District, Edinburg, Tex., August 6, 1996.
- Hall-Ellis, Sylvia D. *Internet Resources for Grant Writers*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., April 20, 1996.
- Hall-Ellis, Sylvia D. *Enhanced Grant Writing Skills for Mathematics Educators: Writing Skills for Campus Teams*. Sponsored and hosted by the Office of General Education, Region One Education Service Center, Edinburg, Tex., March 22, 1996.
- Hall-Ellis, Sylvia D. *Internet Resources for Grant Writers*. Sponsored and hosted by the College of Education and Applied Science, Sam Houston State University, Huntsville, Tex., March 9, 1996.
- Hall-Ellis, Sylvia D. *Grant Writing for Mathematics Educators: A Development Process for Campus Teams*. Sponsored and hosted by the Office of General Education, Region One Education Service Center, Edinburg, Tex., March 4, 1996.
- Hall-Ellis, Sylvia D. *Shaking the Money Tree: Preparing Successful Technology Grant Applications*. Sponsored and hosted by the Office of Technology and Media Services, Region One Education Service Center, Edinburg, Tex., February 29, 1996 and April 29, 1996.
- Hall-Ellis, Sylvia D. *District-wide Technology Planning: Technical Assistance for the Texas Education Agency Initiative*. Sponsored and hosted by the Office of Technology and Media, Region One Education Service Center, Edinburg, Tex., February 2, 1996.
- Hall-Ellis, Sylvia D. *Enhanced Grant Writing Skills*. Sponsored and hosted by Pharr-San Juan-Alamo Independent School District, Pharr, Tex., January 27, 1996.
- Hall-Ellis, Sylvia D. *United States Copyright Act of 1976, Video Transmissions, Computer Software and the Internet*. Sponsored and hosted by the Office of Technology and Media, Region One Education Service Center, Edinburg, Tex., January 24, 1996.
- Hall-Ellis, Sylvia D. *The Grant Writing Development Process*. Sponsored and hosted by Pharr-San Juan-Alamo Independent School District, Pharr, Tex., January 20, 1996.
- Hall-Ellis, Sylvia D. *MARC Cataloging of Materials for Library Media Centers*. Sponsored and hosted by the Office of Media Services, Region One Education Service Center for the Donna Independent School District, Donna, Tex., August 17, 1995.

- Hall-Ellis, Sylvia D. *Classification*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., May 10, 1995.
- Hall-Ellis, Sylvia D. *Library Technical Services*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., April 26, 1995.
- Hall-Ellis, Sylvia D. *Grant Writing: An Introduction for Public School Administrators*. Sponsored and hosted by the Office of Administrative Services, Region One Education Service Center, Edinburg, Tex., April 19, 1995.
- Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21st Century: Visions for the Future*. Sponsored and hosted by the United Independent School District, Laredo, Tex., March 31, 1995.
- Hall-Ellis, Sylvia D. *Using USMARC*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., March 29, 1995.
- Hall-Ellis, Sylvia D. *Library Media Center Policies and Guidelines: How to Prepare for School Board Adoption*. Sponsored and hosted by the Office of Technology and Media Services, La Joya Independent School District, La Joya, Tex., March 10, 1995.
- Hall-Ellis, Sylvia D. *Developing District-wide Policies and Guidelines for Library Media Centers*. Sponsored and hosted by the Office of Technology and Media Services, La Joya Independent School District, La Joya, Tex., January 10, 1995.
- Hall-Ellis, Sylvia D. *MARC Cataloging of Audiovisual Materials for Library Media Centers*. Sponsored and hosted by the Office of Library Media and Technology Services, Cypress-Fairbanks Independent School District, Houston, Tex., December 1, 1994.
- Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21st Century: Visions for the Future*. Sponsored and hosted by United Independent School District, Laredo, Tex., October 14, 1994.
- Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21st Century: Visions for the Future*. Sponsored and hosted by the Laredo Independent School District, Laredo, Tex., October 7, 1994.
- Hall-Ellis, Sylvia D. *MARC Cataloging for Library Media Centers*. Sponsored by the Office of Library Media and Technology Services, Cypress-Fairbanks Independent School District, Houston, Tex., October 5, 1994.
- Hall-Ellis, Sylvia D. *Jump to the Head of the Class: Undergraduate Library Resources Available at Sam Houston State University*. Sponsored by the Office of the Associate Vice President for Student Services, Sam Houston State University, Huntsville, Tex., October 4, 1994.
- Hall-Ellis, Sylvia D. *CD-ROMs - 1994's Newest and the Best for Secondary Level Media Centers*. Sponsored and hosted by Clear Lake Independent School District, Houston, Tex., June 3, 1994.
- Hall-Ellis, Sylvia D. *Introduction to Classification*. Sponsored by AJ Seminars, Rockville, Maryland; presented at Holiday Inn, Market Center, Dallas, Tex., May 18, 1994.
- Hall-Ellis, Sylvia D. *Basic Descriptive Cataloging*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., May 4, 1994.
- Hall-Ellis, Sylvia D. *Shaking the Money Tree - Part II: Writing Successful Grant Applications*. Sponsored by Donna Independent School District, Donna, Texas, and Region One Education Service Center Edinburg, Texas; presented at South Texas Community College Library, McAllen, Tex., April 29, 1994.

Hall-Ellis, Sylvia D. *Using MARC*. Sponsored by AJ Seminars, Rockville, Maryland; presented at Holiday Inn, Market Center, Dallas, Tex., April 6, 1994.

Hall-Ellis, Sylvia D. *Automated Authority Control*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., March 23, 1994.

Hall-Ellis, Sylvia D. *Automating the District School Library Media Centers: Choices and Opportunities*. Sponsored and hosted by the Office of Technology and Library Media Services, Fort Bend Independent School District, Sugar Land, Tex., March 4, 1994.

Hall-Ellis, Sylvia D. *Shaking the Money Tree - Part I: Preparing Successful Grant Applications*. Sponsored and hosted by the Office of Library Media Services, Donna Independent School District, Donna, Tex., February 4, 1994.

GRADUATE COURSES TAUGHT

San José State University, School of Library and Information Science

INFO 249 – Advanced Cataloging and Classification (Fall 2015, 2016; Summer 2016)
INFO 287 – Special Topics in Cataloging and Classification (Spring 2017, 2018)
LIBR 248 – Beginning Cataloging and Classification (Summer 2002, 2003, 2004, 2005, 2006)
LIBR 249 – Advanced Cataloging and Classification (Summer 2003; Fall 2014; Summer 2015)

University of Denver, Morgridge College of Education

HED 5991 – Grant Writing in Higher Education (Spring 2011)
LIS 4010 – Organization of Information (Fall 2002, 2003, 2004, 2005, 2006, 2009; Winter 2005; Spring 2004, 2005, 2006)
LIS 4020 – Professional Principles and Ethics (Summer 2000)
LIS 4040 – Management of Libraries and Information Centers (Fall 2010; Spring 2003, 2009 (DS); Winter 2005)
LIS 4070 – Cataloging and Classification (Winter 2008, 2009, 2010, 2011, 2012; Fall 2009 (DS))
LIS 4321 – Collection Management (Spring 2005)
LIS 4326 – LIS Research (Winter 2009 (DS); Spring 2009 (DS))
LIS 4350 – Adult Materials and Services (Summer 2006, 2009)
LIS 4379 – Social Sciences Resources (Spring 2009)
LIS 4400 – Cataloging and Classification (Spring 2000, 2001; Winter 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009; Summer 2005, 2006 – course renumbered LIS 4070, September 2007)
LIS 4401 – Descriptive Cataloging (Winter 2001; Spring 2002, 2003, 2006, 2007, 2008, 2009; Summer 2005)
LIS 4402 – Subject Cataloging (Spring 2001, 2009; Summer 2005, 2006, 2007, 2008)
LIS 4403 – Classification Schemes (Fall 2007, 2008, 2009 (DS))
LIS 4405 – Authority Control (Winter 2009)
LIS 4510 – Materials and Services for Children (Winter 2004; Summer 2005)
LIS 4620 – Grant Writing and Fundraising (Summer 2000, 2002, 2004, 2010; Winter 2006; Fall 2006, 2007, 2008, 2009)
LIS 4700 – Seminar in Technical Services (Fall 2001)
LIS 4700 – Seminar in Public Libraries (Summer 2002)
LIS 4804 – Management of Electronic Records (Spring 2004; Fall 2005)
LIS 4902 – Capstone Projects (Winter 2003, Spring 2008, 2009, 2011)
LIS 4910 – Independent Study (every quarter Winter 2000 through Spring 2011)
LIS 4920 – Service Learning (every quarter Summer 2004 through Spring 2011)
RMS 4954 – Grant Writing (Summer 2013, 2014)
RMS 4959 – Content Analysis Methodology (Spring 2015)
QRM 4978 – Grant Writing (Summer 2011, 2012)

Rutgers University, School of Communication and Information

SC&I 522 – Cataloging and Classification (Summer 2013)

University of Arizona, College of Behavioral and Social Sciences

LIS 602 – Cataloging and Classification (Summer 1995)
LIS 612 – Advanced Online Search and Retrieval (Summer 1995)

Sam Houston State University, College of Education & Applied Science

LIS 532 - Cataloging and Classification (Fall 1993, 1994, 1995)
LIS 563 - Advanced Cataloging and Classification (Summer 1994)
LIS 567 - Research Methods (Spring 1994, Spring 1995)
LIS 591 - Educational Technology (Spring 1994, 1995)
LIS 596 - Networking and Computer Technologies in Education (Fall 1993, Summer 1994, Fall 1995)

Dissertations at the University of Denver

- Bowers, Stacey L. *Library Anxiety of Law School Students: A Study Utilizing the Multidimensional Library Anxiety Scale*. Chair, May 5, 2010.
- Fattor, Melissa M. *Student Engagement Differences by Ethnicity and Scale for Ninth Grade Students*. Chair, November 1, 2010.
- Fulton, Roseanne. *A Case Study of Culturally Responsive Teaching in Middle School Mathematics*. Kent Seidel, Chair, June 18, 2009, Outside Chair.
- Grealy, Deborah S. *Tribes and Territories in Library and Information Studies Education*. Bruce Uhrmacher, Chair, June 10, 2008, Committee Member.
- McCord, J. Michael. *Developing a Standard of Care for Educational Malpractice*. Chair, April 15, 2011.
- Priebe, Sarah J. *Distinguishing Effects of Domain and General Knowledge on Passage Fluency and Comprehension*. Jan Keenan, Chair. July 21, 2011, Outside Chair.
- Snyder-Mondragon, Sandra M. *Institutional Factors that Impact the Retention of Graduate Students of Color in Schools of Library and Information Science: A Metaregression of Accredited Library School Statistics on Student Retention and Graduation Rates*. Kathy Green, Chair, July 24, 2009, Committee Member.
- Taylor, Karen Pickles. *Effective Teaching*. Elinor Katz, Chair, July 15, 2009, Outside Chair.
- Thompson, Jennifer. *Distinguishing a Western Women's College: A History of the Curriculum and Student Experience at Colorado Women's College*. Edith W. King, Chair, July 16, 2010, Committee Member.
- Walker, Emelda. *Influence of Organizational Factors on Job Satisfaction of Disability Service Providers at Postsecondary Institutions*. Chair, April 29, 2010.

Dissertation Proposals at the University of Denver

- Bowers, Stacey L. *Library Anxiety of Law School Students: A Study Utilizing the Multidimensional Library Anxiety Scale*. Chair, November 5, 2009.
- McCord, J. Michael. *Developing a Standard of Care for Educational Malpractice*. Edith W. King, Chair. April 23, 2010.
- Thompson, Jennifer. *History of Colorado Women's College*. Edith W. King, Chair, October 30, 2008. Committee Member.
- Walker, Emelda. *Influence of Organizational Factors on Job Satisfaction of Disability Service Providers at Postsecondary Institutions*. Chair, July 21, 2009.

Dissertations at Other Institutions

- Rodríguez-Mori, Howard. *The Information Behavior of Puerto Rican Immigrants to Central Florida, 2003-2009: Grounded Analysis of Six Case Studies Use of Social Networks during the Migration Process*. Kathleen Burnett, Chair, April 10, 2009, Florida State University, Committee Member.
- Schwartz, Brian *More than a Look-up Skill: Medical Information Literacy Education in Osteopathic Medical Schools*. D. Mirah Dow, Chair, July 18, 2017. Emporia State University, Committee Member.

Snow, Karen. *A Study of the Perception of Cataloging Quality among Catalogers*. Shawne D. Miksa, Chair, August 1, 2011. University of North Texas, Committee Member.

Dissertation Proposals at Other Institutions

Schwartz, Brian *More than a Look-up Skill: Medical Information Literacy Education in Osteopathic Medical Schools*. D. Mirah Dow, Chair, December 4, 2015. Emporia State University, Committee Member.

Snow, Karen. *A Study of the Perception of Cataloging Quality among Catalogers*. Shawne D. Miksa, Chair, May 11, 2010. University of North Texas, Committee Member.

Master's Thesis at the University of Denver

Hemingson, Jeff. *Recital Paper*. Lamont School of Music, February 2010, Outside Chair.

Capstones at the University of Denver

Anthony, Alisa. *Correlation of Library and Information Science Program outcomes and Vacant Position Qualifications Listed on the Colorado State Library Jobline by Employers During the Period September 1, 2000 through August 31, 2002*. Chair, Winter Quarter, 2003.

Borden, Donna M. *Improving Emergency Communications Systems: Is a Radio Communications Network the Answer?* Fall Quarter, 2014.

Bowden, Heather L.M. *Exploring Biological Models for Long-term Data Preservation*. Chair, Spring Quarter, 2008.

Casenada, Cassandra Y. *Challenges to the Recruitment, Education, and Retention of Librarians of Color*. Chair, Spring Quarter, 2008.

Chang, Jennifer C. *Legal Research Practice and Preference: A Law Firm Perspective*. Chair, Spring Quarter 2011.

Ellis, Megan S. Fitzgerald. *Design of a Public Library Adult Volunteer Recruitment Program and Training Curriculum*. Chair, Winter Quarter, 2003.

Kircher, Kathy. *Development of a Library Pathfinder for Exobiology and Posting it on the Internet*. Chair, Winter Quarter, 2003.

Melhado, Loretta. *Design of St. John's Episcopal Church Library*. Chair, Spring Quarter, 2008.

Radcliff, Kathy. *Original Cataloging of Archival materials in the HERS Collection in Penrose Library*. Chair, Winter Quarter, 2003.

Sass, Carol Ann. *ACT Periodical Index: Access to Catholic Thinking Periodical Index: Web Index to Select Catholic Periodicals*. Spring Quarter 2000.

Stone, Sergio D. *Conducting Community Analysis for the Bemis Public Library (Littleton, Colorado) Using 2002 U.S. Census Data and the Online Outcome-Based Evaluation Toolkit*. Chair, Winter Quarter, 2003.

Tureson, Tamara. *Design and Use of an Information Audit Tool for Use in a Law Library*. Chair, Winter Quarter, 2003.

Tweed, Beth. *Evaluation of Email Reference Service in a Consumer Health Library Environment*. Chair, Winter Quarter, 2003.

GRANTS AND CONTRACTS

Student Learning in Agriculture STEM through Teacher Professional Development. Research team: Stanton Gartin (PI) and Cyndi Hofmeister, Northeast Junior College; Jeff Cash, Cheryl Sánchez, Anne-Marie Crampton, Lamar Community College; Suzanna Spears, Morgan Community College; Jack Wiley, Kerry Gabrielson, Trinidad State Junior College; Michael J. Miller, Colorado State University; Michael Womochil (Co-PI), Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Agriculture, Agriculture and Food Research Initiative, Food, Agriculture, Natural Resources and Human Sciences Education and Literacy Initiative, \$404,460 (2017-2020)

Leading and Achieving: the Colorado Agriculture Regional Consortium. Research team: Jack Wiley (PI), Kerry Gabrielson, Trinidad State Junior College; Jeff Cash (PI), Cheryl Sánchez, Anne-Marie Crampton, Lamar Community College; Suzanna Spears, Morgan Community College; Cyndi Hofmeister, Northeast Junior College; Michael Womochil (Co-PI), Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Agriculture, Hispanic Serving Institutions Education Grants Program, \$504,414 (2017-2020)

Cyber Prep Program Planning Grant. Research team: Debbie Sagen (PI), Brenda Lauer, Pikes Peak Community College; Gretchen Martin, Koiosa Insights; and, Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Commerce, Regional Alliances and Multi-stakeholder Partnerships to Stimulate (RAMPS) Cybersecurity Education and Workforce Development, \$199,681 (2016-2018)

Career and Technical Education in Colorado: Pathways to Education and Employment. Research team: Heather McKay (PI), Rutgers University; Sarah Heath, Casey Sacks, Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Education, Institute of Education Sciences, \$1,400,000 (2017-2021)

Pre-Alliance Planning Grant Colorado Community College Alliance. Research team: Victor Vialpondo (PI) and Janel Highfill, Community College of Aurora; Heidi Loshbaugh (Co-PI), Community College of Denver; Rick Reeves, Bill McGreevy, Liz Cox, and Kristin Aslin, Red Rocks Community College; Cathy Pellish, Front Range Community College; Samuel DeVries, Arapahoe Community College; Sylvia D. Hall-Ellis, Colorado Community College System. National Science Foundation, Louis Stokes Alliance for Minority Participation (LSAMP), \$86,817 (2016-2017)

Towards Scalable Differentiated Instruction Using Technology-enabled, Competency-based, Dynamic Scaffolding. Research team: Karen Wilcox (PI) and Vijay Kumar, Center for Computational Engineering, Massachusetts Institute of Technology; Flora McMartin, Broad-based Knowledge; Quinsigamond Community College; and, Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Education, First in the World Developmental Grant, \$2,891,882 (2015-2019)

Colorado Strategic Partnerships Emergency Grant. Research team: Elise Lowe-Vaughn (PI), Amy Hodson, Celia Hardin, Barbara McBride, James Newby, Christopher Dewhurst, Nina Holland, Kate Anderson, MaryAnn Roe, Chrystalynn Chrystalynn, Elaine Edon, Mona Barnes, Tom Morgan, Rob Hanni, and Marie Valenzuela, Colorado Department of Labor and Employment; Steve Anton, Joelle Brouner, and, Katie Griego, Colorado Department of Human Services; Rebecca Holmes, Judith Martinez, and Jennifer Jirous, Colorado Department of Education; Emily Templin Lesh, Colorado Workforce Development Council; Cory Everett, Colorado Department of Regulatory Agencies; and, Casey Sacks and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Labor, Strategic Partnerships Emergency Grant, \$5,000,000 (2015-2017)

CAEL Jump Start Program: Competency-Based Education. Research team: Jerry Migler (PI), Casey Sacks, Debra Cohn, Thomas Hartman, and Sylvia D. Hall-Ellis, Colorado Community College System; Matt Jamison, Front Range Community College; Mike Coste, Red Rocks Community College; Amanda Corum, Pueblo Community College; Janet Colvin, Pikes Peak Community College; and, MaryAnn Matheny, Community College of Denver. Council for Adult and Experiential Learning, \$15,000 (2015)

Summit on the Redesign of Developmental Education. Research team: Jerry Migler (PI), Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System; Chip Nava, Pueblo Community College; Kim Moultny, Arapahoe Community College; Debbie Ulibarri, Trinidad State Junior College; and, Kris Bernard, Front Range Community College. American Association of Community Colleges, \$15,000 (2015-2016)

Equity in Excellence at Colorado Community Colleges. Research team: Keith Howard (PI) and Sylvia D. Hall-Ellis, Colorado Community College System; Estela Mata Bensimon, Center for Urban Education, University of Southern California; and Kerry Gabrielson, Trinidad State Junior College. Colorado Department of Higher Education, Colorado Opportunity Scholarship Program, \$150,000 (2015-2016)

MBA High School of Business in Colorado. Research team: Laurie Urich (PI) and Sylvia D. Hall-Ellis, Colorado Community College System; Rudolph Sumpter and Beatrice Gerrish, Boulder Valley Schools; Keith Curry Lance, RSL Research Group. Colorado Department of Higher Education, Colorado Opportunity Scholarship Program, \$501,295 (2015-2016)

Fullbridge Program in Colorado. Research team: Keith Howard (PI) and Sylvia D. Hall-Ellis, Colorado Community College System; Suzanna Spears, Fort Morgan Community College; and, Cheryl Sánchez and Anne-Marie Compton, Lamar Community College. Colorado Department of Higher Education, Colorado Opportunity Scholarship Program, \$300,000 (2015-2017)

Colorado Community College System Alternative Credit Program. Research team: Jerry Migler (PI), Keith Howard, and Sylvia D. Hall-Ellis, Colorado Community College System. American Council on Education, \$13,000 (2015)

Internationalization in Higher Education. Researcher: Samuel D. Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$8,000 (2014-2015)

International Perspectives on Bilingual Education. Researcher: Sharolyn Pollard-Durodola. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$3,700 (2014-2015)

Cultivating Culturally Relevant and Responsive Curriculum and Pedagogy in College. Researcher: Samuel Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, iRise Grant, \$5,000 (2014-2015)

Project EMERGE (Educational Model for Evaluation and Replicability in Gifted Environments). Research team: Norma Hafenstein (PI) and Bruce Uhrmacher. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Lynde and Harry Bradley Foundation, \$235,000 (2014-2015)

Collecting Asian American Refugee Stories. Researcher: Samuel Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. American Educational Research Association, Research Grant, \$5,000 (2014-2015)

Developing Expertise in Teaching K-5 Mathematics. Research team: Julie Sarama (PI) and Douglas H. Clements (Co-PI), in partnership with the School of Education at the University of Michigan. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$130,344 (2013-2015)

Investigation of the Long-Term Outcomes for Special Education Students. Researcher: Antonio Olmos-Gallos. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Jefferson County School District, Office of Assessment, \$40,000 (2014)

Refugee Community Collaboration. Researcher: Vicki Tomlin (PI) in partnership with the African Community Center and Jewish Family Service. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$14,854 (2014-2015)

Access to Mathematics for All. Research team: Richard S. Kitchen (PI), Nicole M. Russell (Co-PI), and Terrence Blackman (Co-PI), Curriculum Studies and Teaching Program, Morgridge College of Education; Álvaro Árias (Co-PI, Department of Mathematics); and, James Gray (Co-PI), Department of Mathematics, Community College of Aurora. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, The Robert Noyce Scholarship Program, Capacity Building Project, \$349,926 (2014-2016)

Cognitive Test Battery for Intellectual Disabilities. Research team: Karen Riley (PI), Lyndsay Agans, Jessica Lerner, and Karin Dittrick-Nathan in partnership with David Hessel (PI), The MIND Institute at the University of California – Davis, and Elizabeth Berry-Kravis, Rush University Medical Center. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Institutes of Health, Outcome Measures for Use in Treatment Trials for Individuals with Intellectual and Developmental Disabilities (R01), \$2,499,996 (\$588,672 at DU) (2014-2019)

Broadening Participation in Engineering among Women and Latino/as: A Longitudinal, Multi-Site Study. Researcher: Patton Garriott (PI) in partnership with the University of North Dakota and the University of Missouri. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, HER Core Research, \$677,390 (\$69,992 at DU) (2014-2019)

Designing a Teacher Evaluation System to Improve Teacher Effectiveness for Culturally and Linguistically Diverse Learners. Research team: María del Carmen Salazar (PI), Jessica Lerner, and Kathy Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$29,988 (2014-2016)

Developing a College-Going Culture in Latina/O Families: Exploring the Influence of Funds of Knowledge on Family Outreach Programs. Researcher: Judy Marquez Kiyama. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$18,720 (2014-2016)

Assessment of Quality of Life in Neural Implantation Surgery for the Treatment of Parkinson's Disease. Researcher: Cynthia McRae. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$3,967 (2014-2015)

Pura Vida: Cloud Forest, Curriculum and Cross-Cultural Study. Research team: Norma Hafenstein (PI) and Bruce Uhrmacher (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$8,000 (2014-2015)

Online Course Development for Curriculum and Instruction. Researcher: Ruth Chao. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

Online Course Development for Curriculum and Instruction. Researcher: María del Carmen Salazar. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

Online Course Development for Curriculum and Instruction. Researcher: Jessica Lerner. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

Online Course Development for Curriculum and Instruction. Researcher: Duan Zhang. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

The Mathematics Education of African Americans, 1866 – 1954. Researcher: Nicole M. Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Academy of Education, Spencer Foundation Postdoctoral Fellowship, \$55,000 (2014-2016)

Early Childhood Care and Education Study. Research team: Carrie Germeroth (PI), Melissa Mincic, and Douglas H. Clements. Technical reviewer for MCE: Sylvia D. Hall-Ellis. State of North Dakota, Department of Public Instruction, \$73,500 (2013-2014)

Graduate Level Specialty in Addiction Counselor Training with Emphasis on Integration of Native American Specific Content. Research team: Ruth Chao (PI) and Michael J. Faragher (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. The Galena Foundation, \$289,732 (2013-2016)

The Collecting Asian American and Pacific Islander Refugee Stories (CARS) Project. Researcher: Samuel Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$15,000 (2014)

Parents in Transition: A Multiple Case Study of Parent and Family Orientation Programs. Researcher: Judy Marquéz Kiyama. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$1,500 (2014-2015)

The Sistah Network: Black Women Graduate Students Supporting and Retaining Each Other. Researcher: Nicole M. Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$2,708 (2014-2015)

Evaluation of the Northeast Denver Babies Ready for College Program. Research team: Carrie Germeroth (PI), Melissa Mincic, and Douglas H. Clements. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Mile High Montessori, \$9,922 (2013-2014)

Developing Teaching Expertise in K-5 Mathematics. Research team: Julie Sarama (PI) and Douglas Clements (University of Denver), in partnership with Timothy Boerst (PI), Meghan Shaughnessy, Deborah Ball, Hyman Bass (School of Education at the University of Michigan). Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$449,827 (\$130,344 at the University of Denver) (2013-2015)

Early Learning Care and Education Study Program Grant for the State of North Dakota. Research team: Carrie Germeroth (PI), Melissa Mincic, and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. State of North Dakota Department of Public Instruction, \$73,500 (2013-2014)

Local Professional Learning Community for School Leaders. Research team: Susan Korach (PI), Kristina Hesbol, and Rebecca McClure. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Education Development Center, \$10,950 (2013)

Healthy Eaters, Lifelong Movers 2: Implementing Evidence-Based School Environment, Policy, and Curricular Changes to Increase Opportunities for Healthy Eating and Physical Activity in Low Income, Rural Colorado. Research team: Elaine Berlansky, University of Colorado at Denver (PI), Nicholas Cutforth, University of Denver (Co-PI), and Allison Reeds. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Health Foundation, \$3,103,108 (2013-2017)

Hughes Rare Books Library Room Renovation in the Sturm College of Law. Project team: Patti H. Marks, Sylvia D. Hall-Ellis, and Leigh Elliott. Mabel T. Hughes Charitable Trust, \$34,000 (2013-2014)

The Promise Center Partnership with the Marsico Institute for Early Learning and Literacy and the City and County of Denver. Research team: Karen Riley (PI), Douglas H. Clements (Co-PI), and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. The Piton Foundation, \$223,468 (2013-2014)

Center of Excellence for Problem Gambling. Research team: Ruth Chao (PI) and J. Mike Faragher. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Behavioral Health, \$68,021 (2012-2013)

United Way Implementation and Validation Review. Research team: Douglas H. Clements (PI), Amanda Moreno, and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Mile High United Way, \$19,737 (2013)

Math/Science Partnership in Rural Districts. Research team: Kristen Bunn (PI, Eagle County Schools), Paul Michalec (Co-PI), and Alegra Reiber. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Education, Colorado's Mathematics and Science Partnership Program, \$750,000 (2013-2014)

Mathematics and Science Education of African Americans. Research team: Nicole Russell (PI), Sylvia D. Hall-Ellis, Steve Fisher (Penrose Library). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$29,994 (2013-2015)

Online Course Development for Curriculum and Instruction. Researcher: Nicole Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2013)

Discourse and Opportunity: Undocumented Students and Higher Education Policy. Researcher: Ryan Gildersleeve. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Academy of Education, Spencer Foundation Postdoctoral Fellowship, \$55,000 (2012-2014)

An Anthropological Study of the Latino Graduation Ceremony. Researcher: Ryan Gildersleeve. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Spencer Foundation, \$39,900 (2012-2013)

Fragile-X and Pharmaceutical Company: Clinical Trial of AFQ056. University of California – Davis Children's Hospital MIND Institute (Sacramento), Children's Hospital Denver, and Rush Children's Hospital at Rush University Medical Center (Chicago). Karen Riley, PI. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Novartis Pharmaceuticals Corporation, \$394,206 (2012-2014)

Project Engage, Phase 2, a DAPRA Grant in partnership with Total Immersion Systems, Inc., and Texas A&M University. Research team: Karen Riley (PI) and Lyndsay Agans (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Defense, \$60,000 (2011-2013)

International School Psychology Practicum Exchange. Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$14,951 (2012-2013)

Online Course Development for Curriculum and Instruction. Research team: Bruce Uhrmacher (PI) and Norma Hafenstein (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$18,193 (2012-2014)

Writers in the Schools. Research team: Karen Riley (PI) and Amanda Moreno (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Humanities, \$4,965 (2012-2013)

Learning Ecosystem Validation Grant. Research team: Karen Riley (PI), Lyndsay Agans, Kent Seidel, and Shimelis Assefa. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Bill & Melinda Gates Foundation, \$315,000 (2012-2013)

Project Words of Oral Reading and Language Development (WORLD). Research team: Jorge E. Gonzalez (PI), Texas A&M University; Laura Saenz (Co-PI), University of Texas – Pan American; and, Sharolyn Pollard-Durodola (Co-PI), University of Denver. Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Education, Institute of Education Sciences, \$53,354 (2012-2015); award \$640,718, transfer from Texas A&M University

Increasing the Efficacy of an Early Mathematics Curriculum with Scaffolding Designed to Promote Self-Regulation. Research team: Douglas H. Clements (PI) and Julie Sarama (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Education, Institute of Education Sciences, \$1,445,315 (2008-2014); award \$4,541,975, transfer from University at Buffalo, The State University of New York

Using Rule Space and Poset-based Adaptive Testing Methodologies to Identify Ability Patterns in Early Mathematics and Create a Comprehensive Mathematics Ability Test. Research team: Douglas H. Clements (PI) and Julie Sarama (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$323,791 (2010-2014); award \$1,194,944, transfer from University at Buffalo, The State University of New York

Comprehensive Postdoctoral Training in Scientific Education Research. Researcher: Julie Sarama (PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Education, Institute of Education Sciences, \$133,458 (2010-2014); award \$613,353, transfer from University at Buffalo, The State University of New York

Longitudinal Study of a Successful Scaling Up Project: Extending TRIAD. Research team: Douglas H. Clements (PI), Julie Sarama (Co-PI), and Abt Associates (Carolyn Layzer, Fatih Unlu, Laurie Bozzi, Lily Fesler, Alina Martinez, Cristofer Price, James van Orden). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Institute of Education Sciences, \$384,940 (2011-2015); award \$1,250,286, transfer from University at Buffalo, The State University of New York

Early Childhood Education in the Context of Mathematics, Science, and Literacy. Research team: Julie Sarama (PI), Douglas H. Clements (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$990,020 (2010-2014); award \$2,285,228, transfer from University at Buffalo, The State University of New York

Early Childhood Clearinghouse Information Center Redesign. Research team: Karen Riley (PI) and Amanda Moreno (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Office of the Lt. Governor of Colorado, \$12,000 (2012-2013)

Morgridge Rural Educational Leadership Initiative. Research team: Lyndsay Agans (PI), Linda Brookhart (Co-PI), Susan Korach, and Rebecca McClure. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Morgridge Family Foundation, \$100,000 (2012-2014)

Center of Excellence for Problem Gambling. Research team: Patrick Sherry (PI) and J. Mike Faragher. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Behavioral Health, \$55,000 (2012-2013)

Intermodal Transportation Institute Research Initiatives. Researcher: Patrick Sherry. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University Transportation Centers Program, Research and Innovative Technology Administration, U.S. Department of Transportation. \$600,000 (2012-2014)

Mile High United Way Social Innovation Fund Early Literacy Initiative. Gloria L. Miller, PI, Amanda Moreano, Kim Hartnett-Edwards, and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Mile High United Way, \$89,992 (2012-2013)

International School Psychology Practicum Exchange. Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$1,000 (2012-2013)

Refugee Student Art Outreach. Researcher: Karin Dittrick-Nathan. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$3,000 (2012-2013)

Resistance, Resilience, and Reciprocity: Centering the Voices of Black Doctoral Women with Faculty Aspirations. Researcher: Nicole M. Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$2,965 (2012-2013)

Assessing Learning through Student Notebooks. Research team: Keith Miller, Nancy Sasaki, and Kathy Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$30,000 (2012-2014)

International School Psychology Practicum Exchange. Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$2,000 (2012-2013)

ELO in Colorado. Research team: Cynthia Hazel and Duan Zhang. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Legacy Foundation, \$150,000 (2012-2013)

Creating Online LIS Courses. Research team: Mary C. Stansbury (PI), Shimelis Assefa, Denise Anthony, Xiao Hu, and Krystyna Matusiak. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Teaching and Learning, \$15,000 (2011-2013)

Maritime Piracy Seminar. Researcher: Ved Nanda, The Nanda Center, Sturm College of Law. Technical reviewer for Sturm College of Law: Sylvia D. Hall-Ellis. Arsenault Family Foundation, \$15,000 (2012-2013).

Early Childhood Librarianship: An Interdisciplinary, Experiential Learning MLIS. Researcher: Mary C. Stansbury (PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Laura Bush's 21st Century Librarians Program, Institute for Museums and Library Services, \$249,066 (2012-2014)

Learning Ecosystem Planning Grant. Research team: Karen Riley (PI), Lyndsay Agans, Kent Seidel, and Shimelis Assefa. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Bill & Melinda Gates Foundation, \$281,217 (2011-2012)

Advanced Service Learning Practitioner Faculty Grant, Sylvia D. Hall-Ellis, University of Denver, Center for Community Engagement and Service Learning, \$400 (2011)

Evaluating and Enhancing the EspeciallyMe Program. Research team: Lori D. Patton and Nicole Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, Public Good Fellowship Grant, \$24,780 (2012)

Choosing Excellence: Let Every Child Bloom. Research team: Shimelis Assefa (PI) and Mary C. Stansbury (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, Public Good Grant, \$7,657 (2012)

K-8 STEM Content Specific Professional Development to Improve Elementary Student Achievement. Research team: Kent Seidel (PI), Nicole Russell (Co-PI), Kimberly Hartnett-Edwards, Paul Michalec, Jeff Farmer, Keith Miller, Alegra Reiber, and Nancy Sasaki. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Education, Improving Teacher Quality Grant, (Title II ESEA), \$307,299 (2011-2012)

Building a Better Principal Pipeline to Boost Student Achievement. Researcher: Susan Korach. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Denver Public Schools; a subcontract from the Wallace Foundation Grant, \$170,000 (2011-2017)

Center of Excellence for Problem Gambling. Research team: J. Mike Faragher (Co-PI) and Bobbie Vollmer (PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Behavioral Health, \$79,999 (2011-2012)

An Exploration of Novice Teachers' Core Competencies: Impacts on Student Achievement, and Effectiveness of Preparation. Research team: Kent Seidel (PI), Kathy Green (Co-PI), Kimberly Hartnett-Edwards, and Duan Zhang. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Institute of Education Sciences, Effective Teachers and Effective Teaching, \$990,987 (2012-2015)

Project Engage, a DAPRA Grant in partnership with Total Immersion Systems, Inc., and Texas A&M University. Research team: Karen Riley (PI) and Lyndsay Agans (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Defense, \$49,964 (2011-2014)

User-centered Evaluation of Music Search Engines. Researcher: Xiao Hu. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$2,931 (2011-2012)

Educational Practicum in Vietnam and China to Promote the Inclusion of Young Children with Disabilities. Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$5,000 (2011-2012)

Evaluation of Colorado's Enhancing Quality in Infant-Toddler (EQIT) Initiative. Research team: Virginia R. Maloney and Amanda Moreno. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Buell Foundation, \$395,884 (2011-2013)

Creating Engaging Environments to Teach Pre-Algebra Mathematics to Elementary Students. Research team: Álvaro Arias, Mario López, María del Carmen Salazar, and Lyndsay Agans. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver Interdisciplinary Grant, \$60,000 (2011-2012)

Morgridge Education Technology Accessible (META) Resource Project. Research team: Lyndsay Agans (PI) and Shimelis Assefa (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Morgridge Family Foundation, \$36,000 (2011)

MCE Connect: A 21st Century Framework for Faculty Development. Research team: Bruce Uhrmacher (PI), Shimelis Assefa (Co-PI), Lyndsay Agans (Co-PI), Kimberly Hartnett-Edwards, Norma Hafenstein, Xiao Hu, Paul Michalec (Co-PI), María del Carmen Salazar (Co-PI), and Sandra Snyder-Mondragon. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Teaching and Learning, \$22,355 (2011-2012)

Parent Education and Parent Leadership and Advocacy. Research team: Virginia Maloney (PI) and Amanda Moreno, Marsico Institute for Early Learning and Literacy. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Health Foundation, \$27,358 (2010-2011)

Intentional School Culture. Researcher: Cynthia Hazel. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Denver Public Schools, \$38,040 (2010-2011)

Healthy Eaters, Lifelong Movers: Implementing Evidence-Based School Environment, Policy, and Curricular Changes to Increase Opportunities for Healthy Eating and Physical Activity in Low Income, Rural Colorado. Research team: Elaine Berlansky, University of Colorado at Denver (PI), Nicholas Cutforth, University of Denver (Co-PI), and Allison Reeds. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Health Foundation, \$1,683,277 (2011-2014)

Second Life Learning Community. Research team: Don McCubbrey (PI), Sylvia D. Hall-Ellis (Co-PI), Walter LaMendola, and Paul Novak. University of Denver, Center for Teaching and Learning, \$13,000 (2010-2011)

Reintroducing the Value of Law Librarians to Academic and Public Librarians in Colorado through the Identification and Use of Emerging Technologies. Research team: Sylvia D. Hall-Ellis (Co-PI), Stacey L. Bowers (PI), and Christopher Hudson, in partnership with Denver Public Library, Arapahoe Library District, and the Colorado State Supreme Court Library. University of Denver, Center for Community Engagement and Service Learning, \$5,773 (2010-11)

Reintroducing the Value of Law Librarians to Public Librarians through the Identification and Use of Emerging Technologies and Resources. Research team: Stacey Bowers (PI) and Sylvia D. Hall-Ellis (Co-PI). American Association of Libraries, Wolters Kluwer Law & Business Grant Program, \$2,725 (2010-2011)

Faculty Service Learning Pod. Research team: María del Carmen Salazar and Nicholas Cutforth (Curriculum and Instruction Program), Frank Tuitt (Higher Education Program), Cynthia Hazel and Gloria Miller (Child, Family, and School Psychology Program), and Sylvia D. Hall-Ellis (Library and Information Science Program). University of Denver, Center for Community Engagement and Service Learning, \$8,000 (2010-2011)

Lincoln Collaborative. Research team: Antonio Esquibel (Principal, Lincoln High School), María del Carmen Salazar (Curriculum and Instruction Program), and. Sylvia D. Hall-Ellis. School Improvement Grant, Denver Public Schools, \$375,000 (2010-2012)

Future LEADers of America: Leaders III. Research team: Denver Public Library (Kristen Svendsen, PI), the University of Denver (Sylvia D. Hall-Ellis), the Colorado Chapter of REFORMA (Orlando Archibeque), and the Colorado Association of Libraries (Martin Garner). Laura Bush's Recruiting Librarians for the 21st Century Program, Institute for Museums and Library Services, \$988,366 (2009-2012)

Teaching for Success in the Library Environment: LIS 4030 in Library 2.0. Research team: Deborah S. Greal (PI) and Sylvia D. Hall-Ellis (Co-PI). University of Denver, Center for Teaching and Learning, \$ 9,350 (2009-10)

Writing Group Faculty Grant, Sylvia D. Hall-Ellis, University of Denver, Center for Community Engagement and Service Learning, \$750 (2008-2009)

Collaborative Learning Faculty Grant, Sylvia D. Hall-Ellis, University of Denver, Center for Teaching and Learning, \$1,500 (2008)

Connecting Information Literacy to Learning. Research team: Lori Micho, Merrie Valliant, Amanda Samland, and Sylvia D. Hall-Ellis. Colorado State Library, LSTA Discretionary Grant Program, \$19,548 (2008-2009)

Law Librarianship Fellows Program. Research team: Sylvia D. Hall-Ellis (PI), Stacey Bowers (Co-PI), and Christopher Hudson, Westminster Law Library. Laura Bush's 21st Century Librarians Program, Institute for Museums and Library Services, \$999,370 (2008-2012)

Grant Writing in a Cooperative Learning Environment. Sylvia D. Hall-Ellis. University of Denver, Center for Teaching and Learning, \$2,000 (2008-2009)

Project Homeless Connect 6 Event Evaluation. Research team: Sylvia D. Hall-Ellis and Duan Zhang. University of Denver Center for Community Engagement and Service Learning, \$9,785 (2008)

Project Ecuador: International Learning Service Libraries – A Faculty Development Experience in Ecuador. Sylvia D. Hall-Ellis, Office of Internationalization, University of Denver, \$600 (2007)

Project Ecuador: International Learning Service Libraries – A Faculty Development Experience in Ecuador. Sylvia D. Hall-Ellis, International Service Learning Office, University of Denver, \$400 (2007)

Project Homeless Connect 5 Event Evaluation. Research team: Sylvia D. Hall-Ellis and Duan Zhang. University of Denver Center for Community Engagement and Service Learning, \$1,000 (2007)

Project Homeless Connect 4 Event Evaluation. Research team: Sylvia D. Hall-Ellis and Duan Zhang. University of Denver Center for Community Engagement and Service Learning, \$4,595 (2007)

Future LEADers of America: Leaders II. Research team: Denver Public Library (Kristen Svendsen, PI), the University of Denver (Sylvia D. Hall-Ellis), and the Colorado Chapter of REFORMA (Orlando Archibeque). Laura Bush's Recruiting Librarians for the 21st Century Program, Institute for Museums and Library Services, \$988,518 (2007-2010)

Strategic Planning Assistance for the Denver Medical Library. Sylvia D. Hall-Ellis. Denver Medical Library, Inc., \$30,000 (2006-2007)

Destiny Software for JMAC Student Lab. Sylvia D. Hall-Ellis, gift from the Sagebrush Corporation, Minneapolis, Minnesota, \$10,000 (2006)

Libraries: Tools for Education and Development Worldwide: A Faculty Development Experience in France. Sylvia D. Hall-Ellis, Office of Internationalization, University of Denver, \$800 (2005)

Denver Public Library: Opportunities for Change. Sylvia D. Hall-Ellis, Colorado Community Based Research Network, \$2,000 (2005)

Future LEADers of America. Research team: Denver Public Library (Letty Icolari and Steve Taylor, PIs), Emporia State University (Jim Agee), and the University of Denver (Sylvia D. Hall-Ellis). Recruiting Librarians for the 21st Century Program, Institute for Museums and Library Services, \$670,315 (2005-2008)

American Association of University Professors Summer Institute Professional Development Grant. Sylvia D. Hall-Ellis, American Association of University Professors, \$300 (2005)

Beta Phi Mu Alumni Tea. Sylvia D. Hall-Ellis, gift from the Office of Alumni and Parent and Relations, University of Denver, \$2,000 (2005)

Spectrum Software for LIS Student Lab. Sylvia D. Hall-Ellis, gift from the Sagebrush Corporation, Minneapolis, Minnesota, \$5,000 (2005)

Developing Research Capacity in Community Organizations and Residents through Training and Technical Assistance. Nicholas J. Cutforth (PI) and Sylvia D. Hall-Ellis. Piton Foundation, \$25,000 (2005-2006)

Libraries: Tools for Education and Development Worldwide: A Faculty Development Experience in Argentina. Sylvia D. Hall-Ellis, Office of Internationalization, University of Denver, \$500 (2004)

Developing Research Capacity in Community Organizations and Residents through Training and Technical Assistance. Research team: Nicholas J. Cutforth (PI), Gary Lichtenstein and Sylvia D. Hall-Ellis, Piton Foundation, \$25,000 (2003-2004)

Increasing Spanish-Speaking and Hispanic Diversity among Library and Information Science Students at the University of Denver: Development of a Student Recruitment Model. Researcher: Sylvia D. Hall-Ellis (PI), Office of Multicultural Excellence, University of Denver, \$2,750 (2003-2004)

Collection Development Enrichment to Support the Cataloging & Classification Specialization and School Librarianship within the Library & Information Science Program at the University of Denver. Research team: Sylvia D. Hall-Ellis (PI) and Deborah S. Grealy. Women's Library Association, University of Denver, \$4,000 (2003)

Collection Development Enrichment to Support the Library & Information Science Program at the University of Denver. Research team: Deborah S. Grealy (PI) and Sylvia D. Hall-Ellis. Women's Library Association, University of Denver, \$4,000 (2001)

Wireless LAN for Library Education. Research team: Deborah S. Grealy (PI) and Sylvia Hall-Ellis. University of Denver, Center for Teaching and Learning, \$24,000 (2001-2002)

Upward Bound – A Program for South Texas Youth. Research team: Monte Churchill, Executive Director of Community Relations; Gary R. Saucedo, Outreach Coordinator; Raymond Hernandez, (PI) Associate Dean for Student Success; and Sylvia D. Hall-Ellis, South Texas Community College (McAllen, Texas). U.S. Department of Education, Office of Postsecondary Education, \$2,672,003 (1999-2003)

Write Now! Improving Elementary Students' Writing Skills. Research team: Caryl G. Thomason, Assistant Superintendent (PI); Karen Tankersley, Principal; and, Hal Anderson, Director of Technology, Cheyenne Mountain School District 12 (Colorado Springs, Colorado); and Sylvia D. Hall-Ellis. Colorado Department of Education, Educational Telecommunications Unit, \$189,453 (1999-2001)

Operation Quick Start -- Distance Learning in Rural Colorado. Research team: Randal Weigum, Technology Coordinator (PI); Bonnie Barns, Director of Federal Programs and Staff Development; and, Adam "Joe" Raskop, Executive Director, Southeastern Board of Cooperative Educational Services (Lamar, Colorado); and Sylvia D. Hall-Ellis. Colorado Department of Education, Educational Telecommunications Unit, \$400,000 (1999-2001)

Advanced Technological Training for Information Professionals for the 21st Century. Research team: Mario Reyna, Division of Business Director (PI) and Sylvia D. Hall-Ellis, South Texas Community College (McAllen, Texas). Phi Delta Kappa and the National Science Foundation, \$250,000 (1999-2001)

Working Connections – Training Information Technologies Professionals for the 21st Century. Research team: Mario Reyna, Division of Business Director (PI) and Sylvia D. Hall-Ellis, South Texas Community College (McAllen, Texas). Microsoft Corporation and the American Association of Community Colleges, \$1,147,775 (1999-2001)

The ROAD (Research Oriented Amplification of Development to Literacy) Program. Research team: Deborah J. Leong (PI), Metropolitan State University; Elena Bodrova, Metropolitan State University; Dmitri Semenov, Robert J. Marzano, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Hewlett-Packard Foundation, \$25,000 (1998-1999)

Press to Literacy. Research team: Deborah J. Leong (PI), Metropolitan State University; Elena Bodrova, Metropolitan State University; Dmitri Semenov, Robert J. Marzano, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). The Denver Post and the Robert S. McCormick Foundation, \$49,818 (1998-1999)

International Telementor Center. Research team: David Neils, David B. Frost (PI), and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Hewlett-Packard Philanthropy, \$100,000 (1998-1999)

America Reads: Providing Tutor Training for the America Reads Challenge. Research team: Louis F. Cicchinelli (PI) and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Department of Education, Office of Educational Research and Improvement, \$306,000 (1998-1999)

Comprehensive School Reform. Research team: Louis F. Cicchinelli (PI), J. Timothy Waters, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Department of Education, Office of Educational Research and Improvement, \$285,000 (1998-1999)

Sustainable Energy Education (SEE) Program for Grades 4-8: Preparing Today's Youth for Lifelong Learning and Responsible Actions in Energy Conservation. Research team: Mary Gromko, Colorado Department of Education; Gene McCarthy, Rocky Flats Field Office, U.S. Department of Energy; Gina Kissell, National Renewable Energy Laboratory; and Barbara L. McCombs (PI), Janet L. Bishop, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). State of Colorado Governor's Office for Energy Conservation, \$499,936 (1997-1999)

Review of Kansas Curriculum Standards in Mathematics and Language Arts. Research team: Robert J. Marzano (PI), John S. Kendall, David B. Frost, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Submitted to the Kansas State Department of Education, \$25,903 (1998)

International Telementor Center. Research team: David Neils, John Kuglin, Chris Rapp, David B. Frost (PI), and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Hewlett-Packard Company, \$54,752 (1998)

Genesis Mission: Education Public Outreach. Developed in partnership by the Jet Propulsion Laboratory, California Institute of Technology, Los Alamos National Laboratory, Lockheed Martin Astronautics, and the Mid-continent Regional Educational Laboratory (Aurora, Colorado). Research team: John T. Sutton (PI), Alice Krueger, Martha Henry, Greg Rawls, Shae Isaacs, Jeff Johnson, Deb Jordan, Arlene Mitchell, David B. Frost, Jana Caldwell, J. Timothy Waters, and Sylvia D. Hall-Ellis. National Aeronautics and Space Administration, \$139,700,000; subcontract award, \$4,750,000 (1997-2007)

North Dakota Mathematics Assessment Project. Developed in partnership by the North Dakota Department of Education and Mid-continent Regional Educational Laboratory (Mid-continent Regional Educational Laboratory). Research team: Ann Clapper, Clarence Bina, Greg Gallagher, North Dakota Department of Education; Don Burger (PI), Hillary Michaels, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Office of Education, \$1,618,214; subcontract award, \$389,076 (1997-2001)

Pacific Resources for Education and Learning Distance Education: Project Evaluation. Developed in partnership by the Pacific Educational Community, the Pacific Resources for Education and Learning (PREL), and Mid-continent Regional Educational Laboratory (McREL). Research team: John W. Kofel (PI), Executive Director, PREL; J. Timothy Waters, Executive Director; Joan Buttram, Robert Keller, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Office of Education, Star Schools Program, \$10,000,000; subcontract award, \$500,000 (1997-2002)

Identification of Bilingual Gifted and Talented Children: A Comprehensive School Grants for Bilingual Education. Developed in partnership by Hidalgo (Texas) ISD, Los Fresnos (Texas) CISD, Progreso (Texas) ISD, University of Texas – Pan American (Edinburg, Texas), and Education Service Center, Region One (Edinburg, Texas). Research team: Hilda Medrano, Dean, College of Education, University of Texas – Pan American; Linda Phemister (PI), Janie Navarro, and Sylvia D. Hall-Ellis, Education Service Center, Region One. U.S. Department of Education, Office of Bilingual Education and Minority Languages Affairs, \$1,670,633 (1997-2002)

Academics 2000: First Things First -- The Texas Goals 2000. Developed for Jim Hogg (Hebbronville, Texas) County ISD, Mirando City (Texas) ISD, and San Isidro (Texas) ISD. Research team: Hilda Medrano, Dean, College of Education, University of Texas - Pan American (Edinburg, Texas); Angie Lehmann, Amy Mares, Ellen Gonzalez (PI), and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg, Texas). Texas Education Agency, \$339,987 (1997-2000)

Southwestern Bell's Learning Communities Initiative. Developed for Tech Prep of the Rio Grande Valley, Inc. (Harlingen, Texas); the Center for Professional Teacher Development, University of Texas – Brownsville; Teach for America – Rio Grande Valley (McAllen, Texas); and Education Service Center, Region One (Edinburg, Texas). Research team: Patricia G. Bubb, Executive Director (PI), Tech Prep of the Rio Grande Valley; Martin Winchester, Executive Director, Teach for America – Rio Grande Valley; Aileen Johnson, Director, School of Education, University of Texas – Brownsville; and Sylvia D. Hall-Ellis. Southwestern Bell Foundation, \$100,000 (1997-1998)

Texas School to Work: Regional Implementation. Developed for Tech Prep of the Rio Grande Valley, Inc. (Harlingen), South Texas Community College (McAllen), Texas State Technical College (Harlingen), Texas Southmost College (Brownsville), Empowerment Zone of the Rio Grande Valley (Mercedes), Project VIDA (Weslaco), Youth Fair Chance (McAllen), and Education Service Center, Region One (Edinburg). Research team: Patricia G. Bubb (PI), Tech Prep of the Rio Grande Valley; Stephen Vassberg, Texas State Technical College; Ellen Trevino, Youth Fair Chance; Wanda Garza, Project VIDA; Leonardo Olivares, University of Texas – Pan American; Michael Bell, South Texas Community College; and Sylvia D. Hall-Ellis. Texas Workforce Commission, \$4,250,000 (1997-2002).

Comprehensive Bilingual Education Grant for Hidalgo ISD and Roma ISD. Developed for Hidalgo (Texas) ISD, Roma (Texas) ISD, College of Education, University of Texas – Pan American (Edinburg, Texas), and Education Service Center, Region One (Edinburg, Texas). Research team: Tomas Thomas (PI), Director, Office of Bilingual Education and Sylvia D. Hall-Ellis. U.S. Department of Education, Office of Bilingual Education and Minority Languages Affairs, \$1,531,361 (1997-2002)

Lopez High School, Porter High School, Rivera High School, Central Middle School, and Perkins Middle School, Brownsville (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$1,473,611 (1997-1998)

Donna High School, Todd Middle School, and Solis Middle School, Donna (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$704,052 (1997-1998)

Memorial Middle School and Nellie Schunior Middle School, La Joya Independent School District (Texas). Telecommunications Infrastructure Fund Board, \$293,641 (1997-1998)

Martin High School, Christen Middle School, Cigarroa Middle School, Lamar Middle School, Laredo (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$1,200,000 (1997-1998).

Lasara Middle School, Lasara (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$246,210 (1997-1998)

Los Fresnos High School and Resaca Middle School, Los Fresnos (Texas) Consolidated Independent School District. Telecommunications Infrastructure Fund Board, \$500,000 (1997-1998)

Lyford Junior High School, Lyford (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$354,997 (1997-1998)

Travis Middle School, McAllen (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$269,139 (1997-1998)

Mission High School, Mission (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$297,010 (1997-1998)

Progreso High School, Progreso (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$300,000 (1997-1998)

San Perlita High School, San Perlita (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$293,490 (1997-1998)

Myra Green Junior High School, Raymondville (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$225,000 (1997-1998)

Rio Grande City High School, Ringgold Middle School, Gruella Middle School, Rio Grande City (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$809,934 (1997-1998)

Rio Hondo Junior High School, Rio Hondo (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$297,024 (1997-1998)

Roma High School, Roma (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$333,178 (1997-1998)

San Benito High School, Miller Jordan Junior High School, San Benito (Texas) Consolidated Independent School District. Telecommunications Infrastructure Fund Board, \$547,000 (1997-1998)

Santa Maria High School and Santa Maria Middle School, Santa Maria (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$400,000 (1997-1998)

Salvador High School, United Independent School District (Laredo, Texas). Telecommunications Infrastructure Fund Board, \$250,879 (1997-1998)

Weslaco High School, Cabaza Middle School, Cuellar Middle School, Weslaco (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$874,242 (1997-1998)

Principals' Assessment and Training Center. Developed for Education Service Center, Region One (Edinburg, Texas). Research team: Roberto Zamora, Leonel Barrera, William H. Parry, and Sylvia D. Hall-Ellis. Texas Principals' Leadership Initiative, Texas Association of Secondary School Principals, Texas Association of Elementary School Principals, and the Sid Richardson Foundation. \$461,439 (1996-1998)

The Texas Library Connection -- Integrating and Sharing Resources. Developed for Hidalgo County Library System (McAllen), Cameron County Library System (Brownsville), South Texas Community College (McAllen), the University of Texas - Pan American (Edinburg), University of Texas - Brownsville, and Education Service Center, Region One (Edinburg). Research team: William R. McGee, Coordinator, Hidalgo County Library System; Joe Garcia, Director, Cameron County Library System; Michael D. Bell, Library Director, South Texas Community College; Eleanor Folger Foster, University Library, University of Texas - Pan American; Jaime Vela (PI), Director of Instructional Technology and Media Services, Ron Pontius, Instructional Technology, and Fabiola Fuentes, Media Services, Education Service Center, Region One; and Sylvia D. Hall-Ellis. Office of Library Media Services, Technology Services, Texas Education Agency. \$8,000 (1996-1997)

Developing Leadership Communities for Improving Algebra I for All Students. Developed for a partnership of the Region One Statewide Systemic Initiative Team. Research team: Noel Villarreal (PI), Eduardo Cancino, and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Statewide Systemic Initiative for Reform in Mathematics, Science and Technology Education to The Charles A. Dana Center for Mathematics and Science Education, The University of Texas at Austin. \$25,000 (1996-1997)

Academics 2000: First Things First -- The Texas Goals 2000. Developed for Edinburg (Texas) CISD. Research team: Hilda Medrano, Dean, College of Education, University of Texas - Pan American (Edinburg); Helen Jones, Director (PI), Gifted and Talented Education, Edinburg CISD; and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$750,000 (1996-2001)

Texas Teachers Empowered for Achievement in Mathematics (TEXTEAM) Institute for Algebra I. Developed for Hidalgo ISD, Jim Hogg (Hebbronville) County ISD, La Joya ISD, La Villa ISD, Lyford ISD, Mission CISD, Pharr-San Juan-Alamo ISD, Rio Hondo ISD, San Isidro ISD, San Perlita ISD, Santa Maria ISD, Santa Rosa, Sharyland ISD, Valley View ISD, Webb (Laredo) CISD, Weslaco ISD, and Zapata County (Zapata) ISD. Research team: Noel Villarreal (PI), Chuck McInteer, Ellen M. Gonzalez, Education Service Center, Region One (Edinburg); and Sylvia D. Hall-Ellis. Charles A. Dana Center for Mathematics and Science Education, University of Texas - Austin, \$15,975 (1996)

Community Learning Center for La Villa, Texas. Developed for Edcouch-Elsa Independent School District. Research team: Noe Gonzalez (PI), Assistant Superintendent, Edcouch-Elsa Independent School District, and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$325,000 (1996-1997)

Monte Alto (Texas) Community Learning Center. Developed for Monte Alto Independent School District. Research team: Homero A. Diaz (PI), Superintendent, Monte Alto Independent School District, and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$300,000 (1996-1997)

Community Learning Center for La Villa, Texas. Developed for La Villa Independent School District. Research team: Sam Gonzalez (PI), Assistant Superintendent, La Villa Independent School District; and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$325,000 (1996-1997)

Building Project for Taylor Elementary. Developed for Mercedes (Texas) Independent School District. Research team: Mrs. Denise Rivera, Librarian, and Eduardo Infante, Principal, Taylor Elementary School; Ismael S. Cantu (PI), Federal Programs Director, Mercedes Independent School District; and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$375,000 (1996-1997)

Border Education Network (BEN) - Distance Education through Cable Television. Developed for Edinburg (Texas) Consolidated Independent School District. Research team: Noe Torres (PI), Library Media Specialist, Magdalena Rosas, Library Media and Technology Coordinator, Edinburg Consolidated Independent School District; and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Edinburg (Texas) Consolidated School District, \$250,000 (1996-1997)

Multiservice One-Stop Open Enrollment Charter School. Developed for the Information Referral Resource Assistance, Inc. (McAllen, Texas). Research team: Pablo Perez and Aguié Pena (PI), Executive Director, Information Referral Resource Assistance, Inc.; Roberto Zamora and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$3,066,000 (1996-2001)

Project OK: A Community Youth Opportunities Grant for Summer, 1996. Developed for McAllen (Texas) Independent School District, St. Joseph the Worker Catholic Church, and the Office of Adult Education, Education Service Center, Region One. Research team: Father Bart Flatt, St. Joseph the Worker Catholic Church; Noe Calvillo (PI), Office of Adult Education; Maria Louisa Garcia, McAllen Independent School District; and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Protective and Regulatory Agency through the Office of the Mayor, City of McAllen, \$350,000 (1996-2001).

Early Childhood: a Time of Discovery. Developed for a partnership of Lasara ISD, Rio Hondo ISD, San Perlita ISD, the School of Education, University of Texas - Brownsville, and Education Service Center, Region One (Edinburg). Research team: Hugo Rodriguez, Dean, School of Education, University of Texas - Pan American; Leonel Barrera and Jack Damron, Field Service Agents, Ellen M. Gonzalez (PI), Administrator for Student Instructional Services, Ruth Solis, Education Specialist in Special Education, and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$722,090 (1996-2001)

Innovative Gifted and Talented Programs for Early Childhood and Elementary Education Students. Developed for a partnership of Edinburg (Texas) CISD, the School of Education, University of Texas - Pan American (Edinburg), and Education Service Center, Region One (Edinburg). Research team: Hilda Medrano, Dean, School of Education, University of Texas - Pan American; Helen de la Garza (PI), Director of Elementary Curriculum and Instruction, Edinburg CISD; and Sylvia D. Hall-Ellis. Texas Education Agency, \$750,000 (1996-2001)

Reading Recovery in Early Elementary Grades. Developed for a partnership of La Villa (Texas) ISD the School of Education, University of Texas - Pan American (Edinburg), and Education Service Center, Region One (Edinburg). Research team: Hilda Medrano, Dean, School of Education, University of Texas - Pan American; Marcario Salinas (PI), Supervisor of Elementary Curriculum and Instruction, La Villa ISD; and Sylvia D. Hall-Ellis, Education Service Center, Region One. Texas Education Agency, \$750,000 (1996-2001)

Connected Mathematics Project for Middle and Junior High Students. Developed for a partnership of Michigan State University, The Charles A. Dana Center for Mathematics and Science Education, The University of Texas at Austin and Region One Statewide Systemic Initiative Team. Research team: Jack Damron, Chuck McInteer, Noel Villarreal (PI), and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). National Science Foundation through Michigan State University to the Charles A. Dana Center at the University of Texas - Austin, \$539,610 (1996-1999)

Sharing Resources: Testing the Interlibrary Loan Potential of the Texas Library Connection -- Integrating Media Resources. Developed under the sponsorship of the Hidalgo County Library System (McAllen) and Education Service Center, Region One (Edinburg). Research team: William H. McGee, Hidalgo County System Coordinator; Fabiola Fuentes, Library Media; Ronald Pontius (PI), Instructional Technology, Education Service Center, Region One; and Sylvia D. Hall-Ellis. Library Media Services Program, Office of Technology Services, Texas Education Agency, \$25,000 (1996-1997)

State and Federal Adult Education JOBS Program. Developed for Education Service Center, Region One (Edinburg). Research team: Noe Calvillo (PI), Director, Adult Education Program, and Sylvia D. Hall-Ellis. Adult Education Program, Texas Education Agency, \$532,846 (1995-1996)

Creating Safe and Drug-Free Schools and Communities. Developed for a partnership of the Region One Consortium for Safe and Drug-Free Education Environments. Research team: Clara Contreras (PI), Health Specialist, and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$150,000 (1995-1996)

Developing Leadership Communities for Improving Mathematics Performance for All Students on Title I Campuses. Developed for a partnership of the Region One Statewide Systemic Initiative Team. Research team: Jack Damron, Chuck McInteer, Noel Villarreal (PI), and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Statewide Systemic Initiative for Reform in Mathematics, Science and Technology Education to The Charles A. Dana Center for Mathematics and Science Education, The University of Texas at Austin, \$50,669 (1995-1996)

The Impact of Library Resource Centers on Academic Achievement in Selected Public Schools in South Texas. Sylvia D. Hall-Ellis (PI). Developed under the sponsorship of the Department of Library Science, College of Education and Applied Science, Sam Houston State University (Huntsville). Texas Association of School Librarians, Children's Services Round Table, and Young Adults Round Table (Austin, Texas), \$2,500 (1995)

School Library Media Specialists Fellowship Program. Sylvia D. Hall-Ellis (PI). Developed under the sponsorship of the Department of Library Science, College of Education and Applied Science, Sam Houston State University (Huntsville, Texas). U.S. Department of Education, HEA Title II-B, Library Education and Human Resource Development Program, \$44,000 (1995-1996)

Planning for Educational Technology. Research team: Ruth Ann Riggins (PI), Director of Library Media and Technology Services, Donna (Texas) Independent School District; Noe Torres, Education Service Center, Region One; Patricia G. Bubb, Tech Prep of the Rio Grande Calley, Inc; Michael D. Bell, South Texas Community College; and Sylvia D. Hall-Ellis, Sam Houston State University. Developed under the sponsorship of Donna (Texas) Independent School District, Education Service Center, Region One (Edinburg), Tech Prep of the Rio Grande Valley, Inc. (Harlingen), South Texas Community College (McAllen), and the Department of Library Science, Sam Houston State University (Huntsville). Funded through Infusion of Educational Technology Planning Grant Program (H.B. 18: Models). Texas Education Agency, \$18,000 (1993-1994)

The Impact of Library Resource Centers on Academic Achievement in Selected Public Schools in South Texas. Sylvia D. Hall-Ellis (PI) and Mary Ann Berry. Developed under the sponsorship of the Department of Library Science, College of Education and Applied Science, Sam Houston State University (Huntsville). Sam Houston State University Research Enhancement Fund, \$7,500 (1993-1994)

Electronic Mail Resource Sharing System: Management and Operation of the Iowa Computer-Assisted Network. State Library of Iowa, \$294,000 (1986-1993)

The Iowa Locator: A CD-ROM Resource Sharing Tool. State Library of Iowa, \$567,000 (1986-1992)

Statewide Database Development: An OCLC Tape Analysis To Determine Feasibility. State Library of South Dakota, \$15,000 (1987)

The Iowa Locator: A Feasibility Study. State Library of Iowa, \$50,000 (1986)

Electronic Mail Resource Sharing System: A Feasibility Study for Libraries in the State of Iowa. State Library of Iowa, \$5,000 (1985)

Access Pennsylvania: A Feasibility Study. State Library of Pennsylvania, \$50,000 (1984)

Automating Library Administrative and Management Tasks: Procurement and Distribution of Microcomputer Systems for District Library Centers in the Commonwealth of Pennsylvania. State Library of Pennsylvania, \$495,000 (1982)

Sharing Serial Titles Resources: Procurement and Distribution of Microfiche Readers for 550 Libraries in the Commonwealth of Pennsylvania. State Library of Pennsylvania, \$500,000 (1982)

Electronic Mail System: A Pilot Project for Libraries throughout the Commonwealth of Pennsylvania. State Library of Pennsylvania, \$125,000 (1982)

Literacy Program for Adults in Rural Upstate New York State: Program Outreach and Evaluation - Phase 3. Appalachian Regional Commission, \$50,000 (1981)

Database Building: A Cooperative Project of the Finger Lakes Library System (Ithaca), Four County Library System (Binghamton), and the Southern Tier Library System (Corning). New York State Library, \$450,000 (1980-1985)

Faces of the Southern Tier: A Professional Photographer-in-Residence. New York State National Endowment for the Humanities, \$25,000 (1980)

Literacy Program for Adults in Rural Upstate New York State: Program Implementation - Phase 2. Appalachian Regional Commission, \$50,000 (1980)

Small Business Resources Center: A Pilot Project for Rural Public Libraries. New York State Library, \$50,000 (1980)

Media Programming: A Professional Development Program for Public Librarians in Upstate New York: A Program in Allegheny, Chemung, Schuyler, Steuben, and Yates Counties. New York State Library, \$35,000 (1979)

Information and Library Resources for Inmates and Prisoners in Selected Upstate New York Facilities: A Cooperative Program in Allegheny, Chemung, Schuyler, Steuben, and Yates Counties. New York State Library, \$25,000 (1979)

Library Resources for Homebound Adults in Upstate New York: An Outreach Program in Allegheny, Chemung, Schuyler, Steuben, and Yates Counties. New York State Library, \$40,000 (1979)

Literacy Program for Adults in Rural Upstate New York State: Program Initiation and Establishment - Phase 1. Funded by the Appalachian Regional Commission. Awarded to the Corning (New York) Public Library, \$50,000 (1979)

Information Reference Services to Homebound Adults. New York State Library, \$31,000 (1978)

Books-By-Mail Services to Homebound Adults. New York State Library, \$31,000 (1978)

System Headquarters Services and Programs for Public Libraries in District 10. Funded through Library Services and Construction Act Title I. Texas State Library and Historical Commission, \$880,000 (1976)

County Library Development Grant for Atascosita County. Funded through Library Services and Construction Act Title I. Texas State Library and Historical Commission, \$15,000 (1976)

Spanish Language Materials Collection Development Program. Texas State Library and Historical Commission, \$40,000 (1975)

Establishment of System Headquarters for Alamo Regional Library System (District 10) Headquartered at the San Antonio (Texas) Public Library. Texas State Library and Historical Commission, \$800,000 (1975)

SELECTED CONSULTANTSHIPS

Project Strategic Planning & Funding Proposal Development

Walden University, 2015.

Pikes Peak Library District, 2014.

Douglas County Public Libraries, 2011-2012.

Denver School for Science and Technology, 2008-2011.

Johnson & Wales University, Denver Campus, 2007-2009.

Challenges, Choices, and Images K-12 Charter School, Denver Public Schools, 2007.

Denver Medical Library, Inc., 2006-2010.

Bemis Public Library (Littleton), Ergonomic Design and Facilities Enhancement Consultant, 2003.

Curtis Park Community Center (Denver), Community Technology Center Evaluation and Proposal Development Consultant, 2003.

Colorado Community Based Research Network (Denver), Funding Research Associate, 2002-

Our Lady of the Rosary Academy (Edgewater), Learning Resource Center Development Project Consultant, 2001-

University of Southern Colorado (Pueblo). Technology Integration and Curriculum Enhancement into Higher Education Learning Environment. Proposal Development Consultant, 2000.

Jefferson County Library System (Lakewood), 1999-2000.

Southeastern BOCES (Lamar, CO). Distance Learning Curriculum Content Development Project. Proposal Development Consultant, 1998-2004.

Cheyenne Mountain School District 12 (Colorado Springs, CO). Technology Integration into Elementary Writing Curriculum Project. Proposal Development Consultant, 1998.

Telecommunications Infrastructure Fund Board Round #2 Application, 1997. Technical assistance to the following: La Villa (Texas) Independent School District; Mirando City (Texas) Independent School District; Monte Alto (Texas) Independent School District; San Isidro (Texas) Independent School District.

Telecommunications Infrastructure Fund Board Round #1, 1996. Technical assistance to the following: Brownsville (Texas) Independent School District; Donna (Texas) Independent School District; Edinburg (Texas) Consolidated Independent School District; Harlingen (Texas) Consolidated Independent School District; Jim Hogg County Independent School District (Hebbronville, Texas); La Feria (Texas) Independent School District; La Joya (Texas) Independent School District; La Villa (Texas) Independent School District; Los Fresnos (Texas) Consolidated Independent School District; Progreso (Texas) Independent School District; Raymondville (Texas) Independent School District; Rio Hondo (Texas) Independent School District; San Benito (Texas) Independent School District; Sharyland Independent School District (Mission, Texas); Weslaco (Texas) Independent School District; Zapata (Texas) County Independent School District.

South Texas Community College (McAllen). Strategy Development to Meet the Technology Instructional Needs for Vocational, School-To-Work and Academic Programs, 1994-2000. Development Consultant.

Donna (Texas) Independent School District. Planning for the Infusion of Technology in Middle Schools Serving High At-Risk Students, 1994-1995. Research Associate.

Pettus (Texas) Independent School District. Planning for District-wide Automation in School Library Media Centers: Preparation of Data, and CD-ROM Hardware/Software Configuration Evaluation, 1994. Principal Investigator.

Fort Bend Independent School District (Sugar Land, TX). Planning for District-wide Automation in School Library Media Centers, Preparation of Data, and CD-ROM Hardware/Software Configuration Evaluation, 1994-1995. Principal Investigator.

Northern Waters Library Services (Ashland, WI). Professional Consulting Services to Make Recommendations on the Development of System-Wide Efforts of the Northern Waters Library Service, 1988-1989. Research Associate.

State Library of Iowa (Des Moines). The Iowa Locator Compact Disc to Support Multi-Type Libraries Resource Sharing including Database Design, Building, Production, and Distribution, 1986-1991. Project Director.

State Library of Iowa (Des Moines). Iowa Computer-Assisted Network Development, Enhancement, and Operation, 1985-1992. Technical Director.

State Library of South Dakota (Pierre). Statistical Sampling and Analysis of Multi-Institutional OCLC Archive Tape for Statewide Online Database Building, 1985-1986. Research Associate.

District of Columbia Public Library (Washington, DC). Planning Document for the Retrospective Conversion of Bibliographic Records and Automation Issues in the 1990's, 1984-1985. Research Associate.

State Library of Pennsylvania (Harrisburg). Database Development for High School Libraries, 1984-1985. Research Associate.

MINITEX (Minneapolis, MN). Workshops for Retrospective Conversion, Bar Coding, Library Statistics, and OCLC Serials Format, 1985. Presenter and Research Associate.

ABC Film Consortium (Altoona, Bellefonte, Johnstown, PA). Database Building, System Design, and Implementation of Online Film Booking System, 1983-1985. Database Manager.

Library Automation -- System Design & Implementation

Douglas County Library District (Castle Rock, CO). Library Automation Technical and System Performance Specifications, 2001.

Pharr-San Juan-Alamo Independent School District (Pharr, TX). Library Automation Technical and System Performance Specifications, 1997. Project Development Consultant.

Harlingen (Texas) Independent School District. Planning for District-wide Automation in Junior High School Library Media Centers: Preparation of Data, and CD-ROM Hardware/Software Configuration Evaluation, 1996. Principal Investigator.

Sharyland (Texas) Independent School District. Design and Construction of New Elementary School Library and Technology Resources Center, 1995-1996. Principal Investigator.

South Texas Independent School District (Mercedes, TX). Design and Construction of a New High School Library and Technology Resources Center, 1995-1996. Principal Investigator.

Citizens' Library (Washington, PA). Online Community Resources Files: Design and Implementation, 1984. Research Associate.

Altoona (Pennsylvania) Hospital. Integrated Online System Upgrade Study, 1984. Research Associate.

State Library of South Dakota (Pierre). Automation Plan and State Database Development, 1982-1983. Principal Investigator.

State Library of Pennsylvania (Harrisburg). COM Production and Preparation of the Technical Specifications Document, Procurement, and Distribution of Microcomputers in the Commonwealth of Pennsylvania, 1983-1984. Research Associate.

Altoona (Pennsylvania) Area Public Library. Integrated System (Circulation/Online Catalog) Study, 1982-1983. Principal Investigator.

COPSCAULD (Council of Pennsylvania State College and University Library Directors, Edinboro, PA). Design of Online Media Catalog, 1982. Principal Investigator.

Erie (Pennsylvania) County Library System. Operations Research and Design for Automated Circulation, Hardware Upgrade and Re-Retrospective Conversion, 1982. Research Associate.

Michigan Library Consortium (Lansing, MI). Tape Management System Design and Implementation, 1982-1984. Research Associate.

State Library of Pennsylvania (Harrisburg). Preparation of the Technical Specifications Document, Procurement and Distribution of Microfiche Readers in the Commonwealth of Pennsylvania, 1982. Research Associate.

Community College of Allegheny County, Allegheny Campus (Pittsburgh, PA). Integrated Systems Study, 1981. Principal Investigator.

Community College of Allegheny County, South Campus (West Mifflin, PA). Retrospective Conversion Training Program for Handicapped Students, 1981. Technical Director.

Southern Tier Library System (Corning, NY). OCLC Acquisitions Subsystem Evaluation, 1981. Principal Investigator.

South Central Reference and Research Council (Ithaca, NY). South Central Regional Delivery System, 1980. Principal Investigator.

Southern Tier Library System (Corning, NY). Newspapers on Microfilm in the Chemung-Southern Tier Library System, 1979-1981. Principal Investigator.

Cataloging & Bibliographic Database Building

Challenges, Choices, and Images K-12 Charter School, Denver Public Schools, 2007.

Denver Medical Library, Inc., 2006-2010.

Ricks Gifted and Talented School Library, 2005-

American Humane Society (Englewood), 2004-2006.

Fisher Early Learning Center Library, 2004-

Colorado Community Based Research Network (Denver), 2004-

Boulder Valley School District (Boulder), 2002-2003.

Douglas Public Library District (Castle Rock), 2001-2002.

Bibliographic Center for Research, Inc. (Denver). Original Cataloging, 2001-2003 & 1992-1993. Professional Cataloger. Libraries include Arapahoe Library District (Centennial); Clarke College (Clarke, IA); Kaiser Permanente Center for Health Research (Portland, KS); Douglas County Library System (Carson City, NV); Grinnell College (Grinnell, IA); Kansas State University (Manhattan, KS); Kansas State Library (Topeka, KS); McPherson College (McPherson, KS); Newman University (Wichita, KS); Montana Technical University (Helena, MT); Montana State Library (Helena, MT); University of Texas Southwest Medical Center Library (Dallas, TX); Community College of Southern Nevada (Las Vegas, NV); Pikes Peak Library District (Colorado Springs); Mesa Community College (Grand Junction); Coe College (Cedar Rapids, IA); Briar Cliff College (Sioux City, IA); Tri-Care Health Systems (Aurora); The Penrose-St. Francis Healthcare System (Colorado Springs); Westminster Public Library (Westminster); Lutheran Medical Center Medical Library (Wheat Ridge); American Heritage Center, University of Wyoming (Laramie, WY); National Wildlife Research Center Library (Lakewood); University of Colorado Health Sciences Center, Denison Memorial Library (Denver); Water Resources Library, Denver District Office, Bureau of Land Management (Lakewood); Mesa State Community College Learning Resources Center (Pueblo); Front Range Community College Learning Resources Center (Westminster).

Colorado Historical Society Library (Denver). Original Cataloging of Serials for Multi-Institutional Union Listing Project, 1993. Technical Services Associate. Institutional partners: Denver Art Museum, Denver Museum of Natural History Library, and Denver Botanical Gardens Library.

Arapahoe Library District (Centennial). Original Cataloging of Major Media, 1991.

Original Cataloging Projects: Davis and Elkins College (Elkins, WV), 1989-1990; Waldorf College (Forest City, IA), 1989-1990; Kennametal Corporation (Latrobe, PA), 1984-1985; Pennsylvania Public Libraries Film Center (Harrisburg), 1982-1985.

Retrospective Conversion Projects: North Central Regional Library Service (Mason City, IA), 1987-1988; Southeastern Library Services (Davenport, IA), 1986-1987; Virginia Theological Seminary (Alexandria), 1984-1985; California University of Pennsylvania (California, PA), 1984-1985; Kennametal Corporation (Latrobe, PA), 1984-1985; West Virginia University (Morgantown), 1983-1985; Altoona Area Public Library (Altoona, PA), 1983-1984; George Washington University (Washington, DC), 1983-1984; Indiana University of Pennsylvania (Indiana, PA), 1983-1985; Health Education Center (Pittsburgh), 1983-1984; Central Pennsylvania District Library Center (Bellefonte, PA), 1982-1985; Duquesne University Law School Library (Pittsburgh), 1982-1983; Allegheny County Law Library (Pittsburgh), 1982-1984; Calgon Technical Information Center (Pittsburgh), 1982; Dow Corning Corporation, Technical Information Center (Midland, MI), 1982-1983; Tri-System Public Library Retrospective Conversion Project (Binghamton, Corning, and Ithaca, NY), 1978-1981, Technical Project Director.

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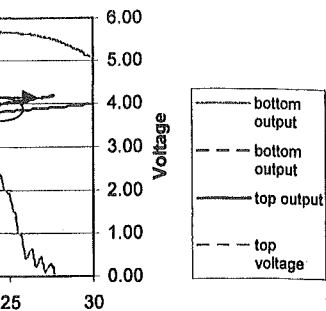
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THE EFFECT OF A PLASMA PRETREATMENT ON THE Si/Si BONDING BEHAVIOUR

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The effect of plasma treatments (reactive ion etching in oxygen- and/or fluorine-containing plasmas) on Si/Si wafer bonding was investigated. Etching in SF₆ caused a bonding behaviour generally known from hydrophobic (HF etched) samples, whereas adding O₂ to the feed gas caused the Si(100) surfaces to become hydrophilic and spontaneous bonding was achieved. Plasma treatments in mixtures of oxygen with SF₆ or CHF₃ result in higher interface bond energies than for hydrophilic bonded wafer pairs already after annealing at T ≥ 400°C. Very strong bonds, however, are even obtained by lower temperature annealing (T ≤ 400°C) after plasma treatments in O₂.

INTRODUCTION

Silicon wafer direct bonding is a technology promising for VLSI, semiconductor power and sensor device applications [1]. For most applications, an additional annealing step at higher temperatures is required after the initial room-temperature bonding in order to increase the bonding strength. There are, however, numerous applications such as the bonding of processed wafers for sensor fabrication, which allow only short postannealing at relatively low temperatures such as 400°C. Therefore, an activation process of the bonding surfaces is desirable, which causes high interface energies already at relatively low temperatures. One possibility of such an activation process is the preparation of interface layers of glass or TMOS (hydrolyzed tetramethoxysilane) which increase the interfacial energy by a factor of 2, or more, with respect to bonded hydrophilic wafer pairs (e.g. [2]). In some cases, however, interface layers are not compatible with device requirements, or their preparation cannot be integrated into the device fabrication process. Another possibility is the modification of surface bonds by plasma processes. Analyses of the bonding behaviour of silicon surfaces exposed to oxygen [3], Ar [4], or Ar/H₂ [5] plasmas showed an appreciable increase in the bonding strength. Treatments in oxygen plasma cause the formation of a thin oxide layer at the bonding interface, whereas surfaces cleaned (etched) in an Ar/H₂ plasma are bondable only after a thermal desorption of hydrogen at temperatures between 400°C and 600°C. Interfaces prepared by the latter procedure are atomically flat, showing no intermediate interface layers. But the bonding strength after room temperature bonding is about the same as for normal hydrophilic wafer bonding. Therefore, other plasma pretreatments compatible with modern device processes are required. Fluorine compounds such as SF₆, CHF₃, or CF₄ and

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their mixtures with O_2 , N_2 , or H_2 are widely applied. All these gases are characterized by a different selectivity of etching silicon or SiO_2 . Therefore, the present paper is concerned with the application of pretreatments in fluorine-containing plasma to wafer bonding. Results of these experiments are compared to pretreatments in an oxygen plasma.

EXPERIMENTAL

Czochralski-grown silicon wafers (diameter 4 in., p-type, $\rho = 30 - 50 \Omega\text{-cm}$) were used for the experiments. After cleaning in standard RCA1,2 solutions, the wafers were plasma treated and subsequently bonded under dry conditions, or by an additional water flushing using the microcleanroom set-up [6]. For the plasma treatment (reactive ion etching, RIE) at 13.56 MHz the following processes were used:

- etching in SF_6 (100%) at a pressure of 25 Pa for 20 sec, a flow rate of 64 sccm SF_6 , and a rf power of 220W,
 - etching in $SF_6/18.9\%O_2$ mixtures ($SF_6 : O_2 = 60 : 14$) at a pressure of 1.4 Pa for up to 160 sec, and a rf power of 80W,
 - etching in CHF_3/O_2 (25sccm/10sccm) at a pressure of 20 Pa for up to 20 sec, and a rf power of 200 W,
 - etching in O_2 at a pressure of 150 Pa for up to 15 min, and a rf power of 600 W.
- All processes were carried out under cleanroom conditions.

The bond energy was measured by the crack opening method in air. Some treatments (especially with oxygen plasma), however, cause the bond energy to increase and the crack opening method to fail. Therefore, the fracture stress was measured by tensile tests. The morphological variations of the plasma-treated surfaces and the structure of the bonding interface were characterized by different microscopic and spectroscopic methods.

RESULTS

Analysis of plasma treated surfaces

Treatments in fluorine-containing plasmas cause the surface roughness to increase (table 1). For instance, due to a plasma process in SF_6/O_2 for 40 sec the surface roughness increased by a factor of more than 2 with respect to an otherwise identical RCA-cleaned wafer. An analogous roughness results from chemical etching in 1% HF solutions for 10 min [7]. The roughness is associated with first indications of a granular structure, which however, is substantially less pronounced than for etching in a CF_4/O_2 plasma for the same time.

Results of spectroscopic ellipsometry (VASE) are shown in fig. 1 for a sample etched in SF_6/O_2 . For modelling the plasma-etched surface, a 2-layer model is assumed on top of bulk silicon consisting of a disturbed silicon layer, about 5.2 nm thick, and an oxide layer. Other common models such as the Bruggeman effective-medium approximation (EMA layer) used for interpreting HF-etched surfaces [8] fail. For the disturbed silicon layer (Si-V), the silicon data for refractive index n and extinction coefficient k are fitted. But as fig. 1 also

shows, the differences of both n and k that it represents a layer damage. Other investigations demonstrate that it represents a layer damage. Furthermore, VASE measurements of CHF_3/O_2 are interpreted on the damaged layer and the data for n and k damage due to the etching by CHF_3 is annihilated by an appropriate

Furthermore, etching in O_2 plasma is observed. Its thickness mainly depends on the exposure time. Measurements of γ show that they are strongly hydrophilic (method) are observed. In contrast, plasma show that the hydrophilicity is deduced to the gas phase. Processes (especially SF_6).

Wafer bonding

Wafers pretreated with the show a more or less spontaneous bonding and additional annealing. Oxygen concentration increasing with pure SF_6 show a bonding (samples fig. 3). The dependence of the structure of the interface are also plasma bond spontaneously. All the interface energy γ is significant. Moreover, γ clearly increases if the plasma treatment is prolonged. Further prolonging the plasma treatment shows considerable differences of γ between the flushing. After bonding under about 2 for plasma treatments up to no difference. The increased value of γ (hydrophilic bonding) indicates that SF_6/O_2 plasma increases the number of bonded hydrophilic wafers. Under conditions and with a preceding treatment conditions the active sites show a higher affinity for bonding H_2O . Increased surface energy γ during the dependence of γ on the treated wafer pairs bonded with the of bonded hydrophilic wafers. A hydrophilic wafers. Moreover, γ

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shows, the differences of both are very small. The physical meaning of the disturbed layer is that it represents a layer damaged by plasma etching. This interpretation is supported by other investigations demonstrating that plasma etching causes Si lattice defects [9,10]. Furthermore, VASE measurements on surfaces analogously etched in other gases (CF_4/O_2 , CHF_3/O_2) are interpreted on the basis of the same model. The thickness of the disturbed (damaged) layer and the data for n and k are slightly different, indicating the different degree of damage due to the etching by different gases. As other authors showed (e.g. [11]), the damage is annihilated by an appropriate postannealing.

Furthermore, etching in pure O_2 causes the formation of a thin oxide layer on the surface. Its thickness mainly depends on the process time. A logarithmic dependence is observed. After long exposure times, however, a damaged layer is also detected by VASE measurements. Measurements of the contact angle of samples treated in an oxygen plasma show that they are strongly hydrophilic. Contact angles of 2° or less (detection limit of the method) are observed. In contrast, measurements on samples treated in a fluorine-containing plasma show that the hydrophilicity is strongly affected by the concentration of oxygen added to the gas phase. Processes with a pure fluorine plasma cause hydrophobic surfaces (especially SF_6).

Wafer bonding

Wafers pretreated with the various plasmas mentioned, except those pretreated in CF_4 , show a more or less spontaneous bonding. The bond energy, measured after room-temperature bonding and additional annealing, is increasing with annealing temperature, and with the oxygen concentration increasing in the fluorine-containing gases (figure 2). Wafers treated with pure SF_6 show a bonding behaviour generally known from hydrophobic (HF-etched) samples (fig. 3). The dependence of the bond energy on the annealing temperature and the structure of the interface are also analogous. In contrast to that, wafers treated in a SF_6/O_2 plasma bond spontaneously. All data measured after bonding at room temperature show that the interface energy γ is significantly higher than for bonded hydrophilic wafer pairs. Moreover, γ clearly increases if the wafers are etched in the SF_6/O_2 plasma for up to 40 sec. Further prolonging the plasma treatment causes γ to decrease again. The data showed appreciable differences of γ between the bonding under dry conditions, and with a preceding water flushing. After bonding under dry conditions at room temperature γ varies by a factor of about 2 for plasma treatments up to 40 sec, whereas after more extended treatments there is no difference. The increased value of γ at room temperature (as compared to that of normal hydrophilic bonding) indicates a change of the surface structure, i.e. the treatment in the SF_6/O_2 plasma increases the number of active sites. Assuming OH-groups as the active sites for bonded hydrophilic wafers, the differences in γ measured between bonding under dry conditions and with a preceding water flushing suggest that especially under room-temperature conditions the active sites produced by the plasma treatment are characterized by a higher affinity for bonding H_2O molecules via OH-groups on the surface, resulting in an increased surface energy γ during bonding. The complexity of the mechanism is demonstrated by the dependence of γ on the annealing temperature (figure 4). For $T < 400^\circ\text{C}$, plasma-treated wafer pairs bonded with a preceding water flushing yield values of γ similar to those of bonded hydrophilic wafers. After annealings above 400°C , γ is higher than for bonded hydrophilic wafers. Moreover, γ values measured after annealing plasma-treated wafers bon-

ded under dry conditions, are substantially lower than for a bonded hydrophilic wafer pairs (fig. 3).

There is an analogous behaviour also with respect to the interface defect generation (bubble generation) between SF_6 (100%) etched wafers and hydrophobic ones on the one hand, and SF_6/O_2 etched wafers and hydrophilic ones, on the other. Figure 4 shows infrared microscope images of the same wafer pair after room-temperature bonding and after annealings at 200, 400, and 600 °C, respectively, for 1 hour. Here, plasma etching in SF_6/O_2 and a preceding water flushing before bonding were applied. The generation of bubbles seems to be similar to that observed in bonded hydrophilic wafer pairs. Further annealing at higher temperatures reduces the bubble density. Interfaces without bubbles may be realized after single-step annealing at high temperatures. The same holds true also for SF_6/O_2 etched and dry-bonded wafer pairs as well as for samples etched in pure SF_6 , only.

Wafers bonded after being treated with an oxygen plasma result in bond energies of 0.1 to 0.2 J/m² after bonding at room temperature. The bond energy increases, however, substantially with increasing temperature (fig. 2). Strong bonds arise already after annealing at 300°C for short times. The generation of interface defects (bubbles) during annealing is mainly affected by the duration of the plasma treatment and the water flushing before bonding. Infrared microscopy did not reveal any bubbles on the samples plasma-treated before being water flushed. In contrast to that, bubbles appear in dry-bonded wafer pairs after the same annealing. This suggests that treatments in an oxygen plasma also crack residual carbon hydrogen compounds on the wafer surface, which are removed by water flushing.

Interfacial structure

Cross-sectional samples were prepared for high-resolution electron microscopy after annealing wafer pairs at 1100°C for 5 hours. Typical images of the interface structure are shown in figure 5. For instance, etching in pure SF_6 and SF_6/O_2 causes an interface structure analogous to that after chemical etching in HF solutions. Moreover, there are no differences in the interface structure of SF_6/O_2 -etched samples between wafer pairs bonded with a preceding water flushing, and without. The oxide layer on the surface is always removed and both Si surfaces are directly bonded to each other. The bonded interfaces are not atomically flat as for etching in Ar/H_2 plasma [5]. Instead, the interface represents a 1 to 2 nm thick defective layer. Most of the defects within the layer are of a rod-like morphology and oriented parallel to {111} lattice planes. They cannot be observed in plan-view samples due to their 1-dimensional extension. Rod-like defects were shown to consist of silicon self-interstitials rather than of foreign phases composed of impurities detected by SIMS [11]. The reason for such a defective interface layer is assumed to be the same for SF_6 or SF_6/O_2 etched wafer pairs as described for HF-etched ones. For the latter, an accommodation process of two rough surfaces during annealing was suggested [7].

Furthermore, etching in CHF_3 causes a completely different interface structure. Here, an amorphous layer is detected in the interface. The intermediate layer is assumed to consist of fluorocarbons and/or hydrocarbon compounds, forming residual layers on the silicon surface during the plasma treatment [12]. Note that the interface is not atomically flat. In some cases cavities, which are more than 10 nm deep, are observed. In contrast, bonded interfaces

of wafer pairs treated with (2n) oxide layer.

Wafers pretreated with bond energy, measured at increasing with the temperature the fluorine-containing gas behaviour, but a higher inter is, however, no intermediate are measured for wafer pair 400°C.

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- [12] G.E. Potter, G.H. M B10, 2398 (1992)

Table 1: Results of roughness Data were collected

RCA cleaned sample
CHF_3/O_2 , 40 sec
SF_6/O_2 , 40 sec
O_2 , 5min
CF_4 , 40 sec

of a bonded hydrophilic wafer pairs

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plasma result in bond energies of 0.1 and energy increases, however, sub-bonds arise already after annealing at defects (bubbles) during annealing is and the water flushing before bon- the samples plasma-treated before in dry-bonded wafer pairs after the en plasma also crack residual carbon moved by water flushing.

resolution electron microscopy after images of the interface structure are SF₆/O₂ causes an interface structure . Moreover, there are no differences between wafer pairs bonded with a pre- the surface is always removed and bonded interfaces are not atomically interface represents a 1 to 2 nm thick of a rod-like morphology and orien- served in plan-view samples due to known to consist of silicon self-inter- urities detected by SIMS [11]. The be the same for SF₆ or SF₆/O₂ etched er, an accommodation process of two

y different interface structure. Here, intermediate layer is assumed to consist ng residual layers on the silicon sur- face is not atomically flat. In some served. In contrast, bonded interfaces

of wafer pairs treated with oxygen plasma are atomically flat and characterized by a thin ($d \approx 2n$) oxide layer.

CONCLUSIONS

Wafers pretreated with various plasmas show a more or less spontaneous bonding. The bond energy, measured after room-temperature bonding and additional annealing, is increasing with the temperature of annealing and with the oxygen concentration increasing in the fluorine-containing gases. Treatments in SF₆/O₂ mixtures caused a hydrophilic bonding behaviour, but a higher interface bond energy than for hydrophilic bonded wafer pairs. There is, however, no intermediate (oxide) layer at their Si/Si interface. The highest bond energies are measured for wafer pairs pretreated in an oxygen plasma already after annealing at $T < 400^\circ\text{C}$.

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Table 1: Results of roughness analysis on plasma-etched Si(100) surfaces.
Data were collected from AFM measurements (analyzed area $1 \times 1 \mu\text{m}^2$).

	Rms (Rq) [nm]	Ra [nm]	Rmax [nm]
RCA cleaned sample	0.128	0.102	1.176
CHF ₃ /O ₂ , 40 sec	0.317	0.255	2.778
SF ₆ /O ₂ , 40 sec	0.268	0.215	2.116
O ₂ , 5min	0.157	0.125	1.523
CF ₄ , 40 sec	1.114	0.898	9.423

2	22.461 Å
1	52.57 Å
0	0.5 mm
0	0.5 mm

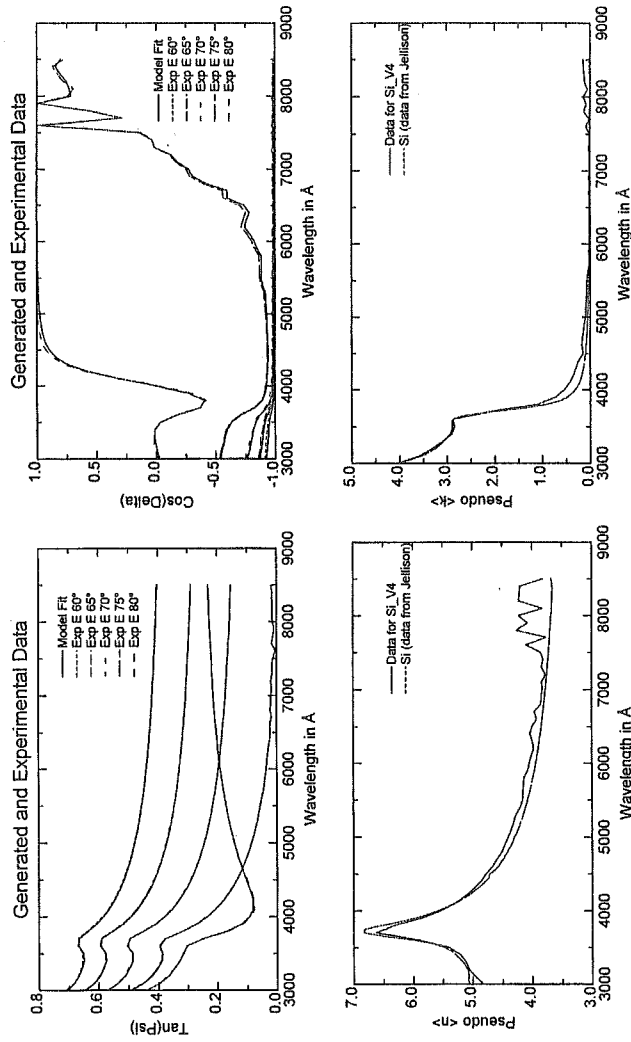


Figure 1: Ellipsometric analysis of a Si(100) surface etched in a SF₆/18.9%O₂ plasma for 40 sec. The model used for data fit (a), the experimentally generated data for the amplitude ratio Ψ (b) and the phase shift difference Δ (c) as well as the data used for refractive index n (d) and extinction coefficient k (e) for modeling the disturbed layer (Si-V).

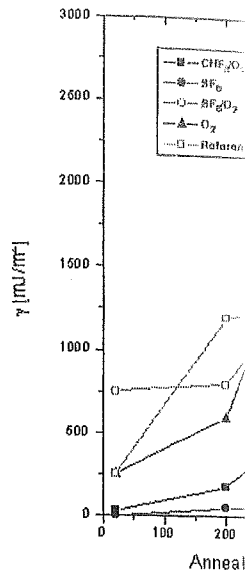


Figure 2: Dependence of the interfacial energy γ on anneal temperature during additional anneal (the figure shows a bonded hydrocarbon layer under the conditions). Measurements by the



Figure 3: Plasma-treated (SF₆, 18.9% O₂) surface after room-temperature anneal.

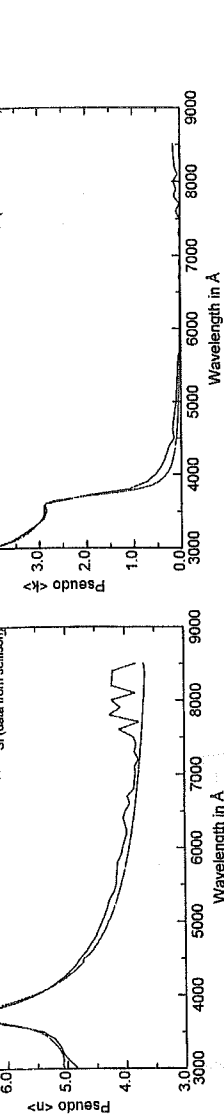


Figure 1: Ellipsometric analysis of a Si(100) surface etched in a SF₆/18.9%O₂ plasma for 40 sec. The model used for data fit (a), the experimentally generated data for the amplitude ratio Ψ (b) and the phase shift difference Δ (c) as well as the data used for refractive index n (d) and extinction coefficient k (e) for modeling the disturbed layer (Si-V).

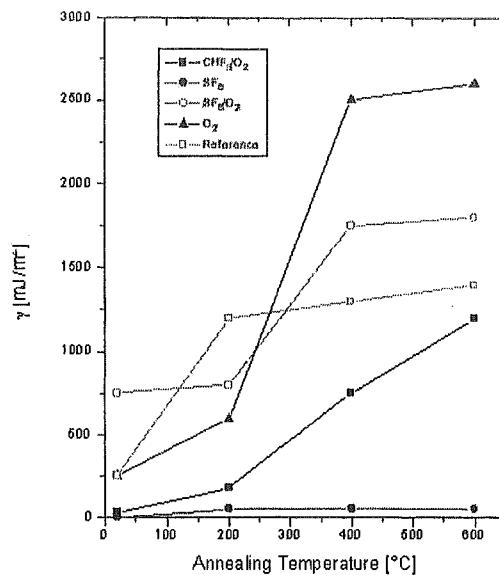


Figure 2: Dependence of the interface bond energy γ on the plasma pretreatment and on the temperature during additional annealing for 1 hour after bonding. The figure shows a bonded hydrophilic wafer pair as reference (data for equilibrium conditions). Measurements by the crack propagation method.

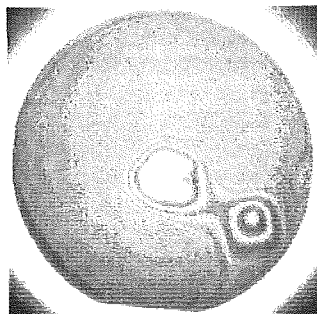


Figure 3: Plasma-treated (SF₆, 1 min) and subsequently bonded wafer pair. Infrared microscope image after room-temperature bonding.

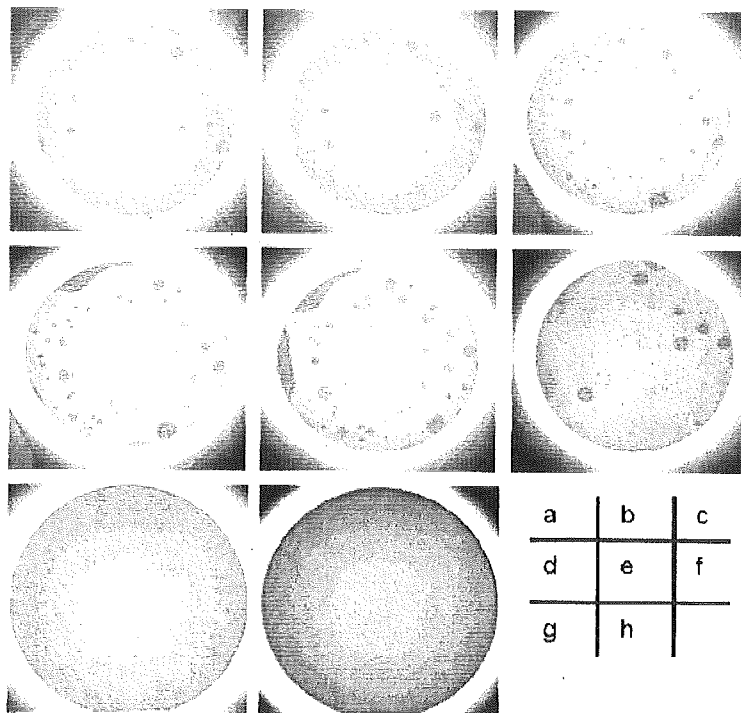


Figure 4: Infrared transmission images of bonded wafer pairs pretreated by etching in an SF_6/O_2 plasma (a – f) and an O_2 plasma (g,h).

a – f - Images of a wafer pair after room-temperature bonding (a) and after annealing for 1 hour at 200°C (b), 400°C (c), 600°C (d), 800°C (e), and 1100°C (f).

g,h - Image of a wafer pair after room-temperature bonding (a) and after annealing at 300°C for 5 hours.

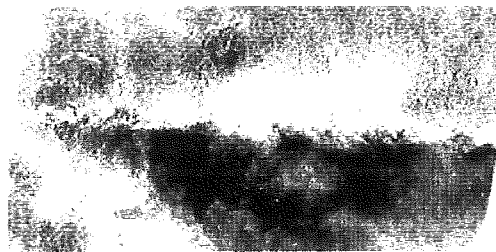


Figure 5: Electron microscope image of the interface of a bonded wafer pair pretreated in a SF_6/O_2 plasma for 40 sec. After bonding the wafer pair was annealed at 1100°C for 5 hours.

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There exist technique them more resistant to oxida dilute hydrofluoric acid, whi hydrogen passivating the surt hours [3]. Other approaches monolayer coverage of C_{60} [4] of more than a few hours. A semiconductor surfaces are i little practical significance.

PROCEEDINGS OF THE FOURTH
INTERNATIONAL SYMPOSIUM ON

SEMICONDUCTOR WAFER BONDING: SCIENCE, TECHNOLOGY, AND APPLICATIONS

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The Fourth International Symposium on Wafer Bonding, held in the summer 1997, continued the tradition of the series started in 1993 at Reno, in 1993 at Honolulu, and in 1995 at San Jose. The series has certainly created more awareness of the importance of wafer bonding and helped in the development of approaches in products now common in the microelectronics industry: wafers, pressure sensors, and light-emitting diodes. The Wafer Bonding Symposium was inaugurated by the International Symposium on SOI Technologies with the same title. The paper by Bruel on "smart-cut" technology presented today will be available in the proceedings of the symposium. The day attended sessions demonstrated again the progress in wafer bonding science and technology. Especially, the interest in wafer bonding has increased. The "smart-cut" approach to wafer thinning is a range of invited and contributed papers on this subject. The other most recent developments in the fabrication of so-called compliant substrates by using ultrathin SOI layers. Although the manuscript could be obtained for these

We especially acknowledge the efforts of those to whom also served as co-chairpersons, the American Chemical Society, Electronics Division and the Society for Electrochemical Science and execution of the symposium and the organization. We owe thanks to Christine Scholze, Plössl for helping in putting together the symposium in a most excellent manner. The excellent response to the organization of a follow-up symposium on Hawaii as part of the Electrochemical Society. We hope to see

Halle, Germany
November 1997

PREFACE

3-27-98 G.W.

The Fourth International Symposium on Wafer Bonding held at Paris in summer 1997, continued the tradition of its predecessors held in 1995 at Reno, in 1993 at Honolulu, and in 1991 at Phoenix. This symposium series has certainly created more awareness of the possibilities offered by wafer bonding and helped in incorporating wafer bonding approaches in products now commercially available, such as SOI wafers, pressure sensors, and light-emitting diodes. Two-and-a half-day Wafer Bonding Symposium was immediately followed by the 8th Symposium on SOI Technologies with one day of overlap sessions. The paper by Bruel on "smart-cut" technology presented during this day will be available in the proceedings of both symposia. The well attended sessions demonstrated again the growing interest in wafer bonding science and technology. Especially two recent developments have increased the interest in wafer bonding technology. One is the "smart-cut" approach to wafer thinning developed at LETI. A whole range of invited and contributed papers dealt with various aspects of this subject. The other most recent development concerns the fabrication of so-called compliant substrates by twist wafer bonding or by using ultrathin SOI layers. Although covered in an invited talk, no manuscript could be obtained for these proceedings.

We especially acknowledge the efforts of the invited speakers, most of whom also served as co-chairpersons. We also thank the officers of the Electronics Division and the Society for their support in the planning and execution of the symposium and the preparation of this volume. We owe thanks to Christine Scholz, Gertrud Kräuter and Andreas Ploessl for helping in putting together the proceedings in a timely manner. The excellent response to the symposium prompted the organization of a follow-up symposium which is planned to be held again on Hawaii as part of the 1999 Fall Meeting of The Electrochemical Society. We hope to see you there.

Halle, Germany
November 1997

U. Gösele
H. Baumgart
Ch. Hunt
T. Abe
S. Iyer

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Systematic Low Temperature Silicon Bonding using Pressure and Temperature

Y. Albert LI and Robert W. BOWER

Department of Electrical and Computer Engineering, University of California Davis, Davis, CA 95616, USA

(Received August 14, 1997; accepted for publication December 16, 1997)

We have developed a systematic three-step process to low temperature direct bond silicon and/or SiO_2 surfaces. The process activates the surface with ammonia, argon and oxygen plasma. While these activation processes allow a very strong low temperature bond to be created, they require techniques distinctly different from those found in previous work for reproducible results. The plasma processes do not result in a bond that propagates as a wave resulting from a point source initiation. A substantial pressure is required to initiate the bond. We have found that a three-step process using pressure and temperature results in very strong, reproducible bonds.

KEYWORDS: low temperature direct bond, plasma, surface activation

1. Introduction

Direct bonding of silicon and other materials commonly used in semiconductor structures is a subject of considerable interest in recent years that is summarized in a review article by Bengtsson.¹⁾ The processes used to create strong, direct bonds differ considerably by various researchers. Work that is reported in several articles describes a process where a water bond is initiated from pressure applied at a point source that propagates across the surface as a wave.^{2,3)} This point source initiation is also reported to produce void free bonds for sodium silicate bonded surfaces.⁴⁾ It has also been our experience that bonds formed with an H_2O precursor can be effectively initiated at a point that generates a wave that propagates across the surface. However, a number of papers that describe direct bonds to silicon make no reference to propagation of a surface wave propagating from a point.⁵⁻⁷⁾ The bonds reported in these articles, however, do not result from an initial water bond.⁵⁻⁷⁾ No reference to contact waves is found in the initiation of bonds that form after plasma activation.⁸⁻¹⁰⁾ Plasma Activated low temperature Bonds (PAB) have been described in earlier publications, without the initial bond forming from a wave propagating across the surface.^{11,12)} While PAB do not propagate as a wave, this technique does require the application of considerable pressure applied over a substantial portion of the surface. In past PAB work this pressure has been applied with tweezers and involved a good deal of artistic talent to generate successful bonds.¹¹⁻¹⁵⁾ In this work a systematic procedure has been developed that results in reproducible strong bonds after a low temperature anneal.

2. Development of the Process

Low temperature direct bonding requires smooth, flat samples. The process begins with a cleaning process and is followed by a surface activation described in earlier work.¹¹⁻¹⁵⁾

In this work the bond is initiated by the application of a uniform pressure to the samples being bonded. It is known from earlier work that the initial PAB are weak and require substantial pressure to initiate.¹³⁻¹⁵⁾ In fact, the initial bond produced in the PAB process is much weaker than generally found in a conventional process with water bonds.^{2,3)} As a result of this weak initial bond the pair has often debonded due to the shear forces during the thermal shock of the final anneal step before a strong bond can develop. Therefore, a systematic three-step

process was developed using PAB to avoid:

- (1) The artistic nature of the tweezers pressure application. And
- (2) The debonding of the initial plasma activated pair due to thermal shear fracture of the weak bond.

The following three-step systematic process has been developed for oxygen plasma activated low temperature bonding. We have found that the application of pressure in the first two steps of this process is essential for the generation of a uniform strong bond on clean semiconductor surfaces. The three step process consists of:

- (1) **Pressure.** A pressure of greater than $2.1 \times 10^5 \text{ N/m}^2$ applied for 10 min was found to be necessary for a high likelihood of a uniform bond.
- (2) **Pressure with temperature.** The application of a pressure of greater than $4 \times 10^5 \text{ N/m}^2$ at a temperature of 200°C , for a period of 30 min was found to overcome the tendency of the pieces to debond during a final anneal process. It was found that while this intermediate pressure and temperature step did not produce a strong bond, it was strong enough avoid debonding when followed by a final anneal.
- (3) **Temperature.** While the intermediate (step 2) pressure and temperature anneal produced a high likelihood of a uniform bond, the strength of this bond was weak. A final anneal of 200°C for 24 h increased the bond strength greater than that of a normal high temperature direct bond or $> 1,000 \text{ erg/cm}^2$.

Similar three-step process has also been found appropriate for both ammonia and argon PAB, with variations in the required pressures for step 1 and 2.

3. Material Preparation and Experimental Procedure

The following process is completed in a class-100 cleanroom at University of California, Davis to reduce the particle count to the lowest level. 100-mm commercial Czochralski (CZ) (100) silicon wafers are used in this work. The wafers are n-type with a resistivity of $1-2 \Omega\cdot\text{cm}$ and thickness of $500-550 \mu\text{m}$. The wafers are then cut into $2 \text{ cm} \times 2 \text{ cm}$ square samples. All attempted bonding samples receive a regular RCA clean, which is a base bath with $\text{NH}_4\text{OH} : \text{H}_2\text{O}_2 : \text{H}_2\text{O} = 1 : 1 : 6$, di-ionized DI water rinse followed by an acid bath with $\text{HCL} : \text{H}_2\text{O}_2 : \text{H}_2\text{O} = 1 : 1 : 7$ and a final DI water rinse. Both base bath and acid bath solutions are set at 75°C . Buffered oxide etch (BOE) dip produces no

observable difference in bonding results, which implies that this process works for both bare silicon and SiO₂ surfaces. The samples are dried in a N₂ gun after the final DI water rinse. A Technics 800 series micro reactive ion etcher (RIE) is used for the surface plasma activation process. The samples, which are handled by vacuum tweezers only during the whole process (this prevents any unnecessary damage on the wafer surface), are put into the chamber, bonding face up. The chamber is pumped to 35 mTorr, backfilled by oxygen at a flow rate of 10 sccm, the mass flow controller is adjusted till the pressure is at 135 mTorr. The activation proceeds at the power of 100 watts for a period of 10 min. After the plasma surfaces treatment, a pair of samples is placed face-to-face into a pressure fixture shown in Fig. 1, where the spring is well calibrated and well controlled by turning the two knobs. The pair to be bonded is held between two perfectly flat gauge blocks, where there is a little hole in the center of each, and the pressure is applied through a stainless still ball which sits on the hole of the top gauge block. This plate is thus gimbaled by the still ball to keep the plates parallel during the application of pressure. A uniform pressure is therefore applied to the whole surface of the bonded pair.

4. Experimental Results and Analysis

The experimental results in the following three tables for oxygen plasma activated samples classify the results by the nature of the infrared interference patterns seen in the bonded pairs at various stages of the three-step process. The bond type classification system rates the bond quality on a scale of 1 to 5, with the type 5 most likely to form a high quality strong bond after the final anneal (step 3) and a type 1 the least likely to form such a bond. Details of the bond type classification scheme are given in the Appendix.

Experimental results are shown below where Tables I, II and III represents the results of step 1, 2, and 3 respectively in this three-step process. The raw bond type is given for each applied pressure, the average types of bond and the likelihood

of producing uniform (type 4 or 5) bonds are calculated. Statistical descriptions appropriate for the small sample sizes and the discrete, subjective bond classification system has been employed.

Table I represents the bond rating for the initial bond found as a function of pressures ranging from 1.1×10^5 N/m² to 5.3×10^5 N/m². Column (I) gives the applied pressure, column (II) shows the classification types of bond corresponding to that pressure for each sample analyzed. The average type of bonds is calculated in column (III), and column (IV) gives the likelihood of forming a type 4 or 5 bonds, where the likelihood defined as the ratio of type 4 or 5 bonds produced compared with the total number attempted. Figure 2 shows a graph of these data where the bond classification improves only slightly for pressures greater than 3.5×10^5 N/m². Figure 3 plots the likelihood of producing a type 4 or 5 bond and shows that a pressure of 2.1×10^5 N/m² is a pressure that has a likelihood of greater than 50% of producing a type 4 or

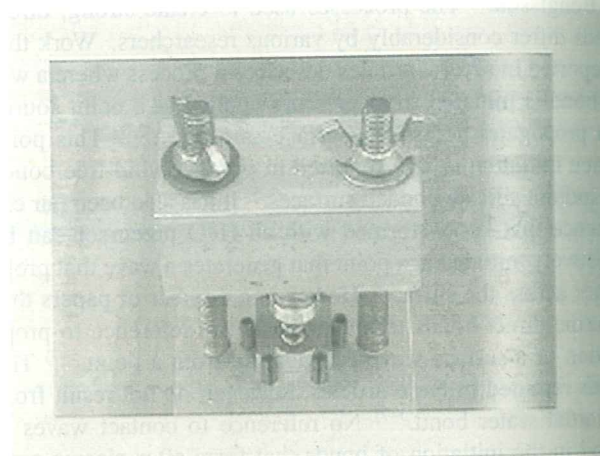


Fig. 1. Pressure fixture.

Table I. Initial bonding results with pressure only.

Pressure ($\times 10^5$ N/m ²) (I)	Bond type data (II)	Average type of bond (III)	Likelihood of a 4 or 5 bonds (%) (IV)
1.1	1, 3, 3, 1, 4, 4, 3, 2, 3	2.67	22.2
2.1	5, 5, 4, 5, 4, 5, 4, 4, 2.5, 1, 3, 2, 2.5, 3.5, 4, 3,	3.62	52.9
3.2	5, 5, 5, 3, 5, 4, 2, 2	3.86	62.5
4.3	5, 4, 2, 4, 5, 5	4.17	83.3
5.3	3, 4, 4, 4, 4.5, 4, 4.5, 4, 3, 4.5, 5, 5, 5	4.19	84.6

Table II. Bonding samples after pressure and temperature.

Pressure ($\times 10^5$ N/m ²) (I)	Bond type data (II)	Average type of bond (III)	Likelihood (%) (IV)
1.516	3.5, 3, 2.5, 2	2.75	0
2.067	2, 2.5, 2.5, 3.5, 2.5, 3.5, 3	2.8	0
2.549	3, 2, 5	3.3	33.3
3.101	4, 3.5, 3, 3, 2.5, 5, 4.5, 3.5	3.63	37.5
4.134	4, 3.5, 5, 4.5, 4.5, 5,	4.25	83.3
5.168	4, 5, 5, 5, 5, 5, 4.5, 5, 5, 4.5, 4.5	4.8	100

Table III. Bond types before and after the third (200°C anneal) step with or without the intermediate step (second step with both temperature and pressure).

Anneal results w/o step 2 (before/after)	
(A)	(B)
2/3, 4/5, 2/2.5, 5/5, 5/5, 4/5, 2/2, 3/5, 5/5, 3/3, 2/3, 5/5, 2/2.5, 5/5, 4/4.5, 3/3, 5/5, 5/5, 3/4, 5/5, 4/4, 5/4, 5/5, 5/5, 2/2, 4/3.5, 2/2, 4/4, 2/4, 2/2, 2/2, 3/3, 4/4, 3/3, 4/4, 5/5, 5/5, 5/5, 2.5/2.5	5/1, 5/1, 4/1, 5/1, 5/1, 5/1, 3/2, 3/2, 2/1, 2/1, 5/1, 4/2, 4/3, 3/2, 2/3, 3/1, 5/1, 4/1, 5/1, 3/1, 5/1, 3/1, 2/2, 5/1, 5/1, 3/1, 3/3

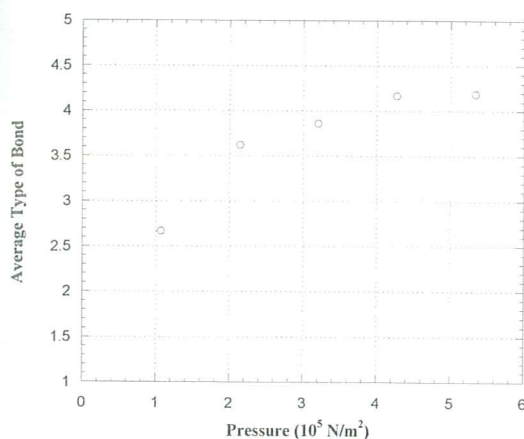


Fig. 2. Average initial type of bond with pressure only.

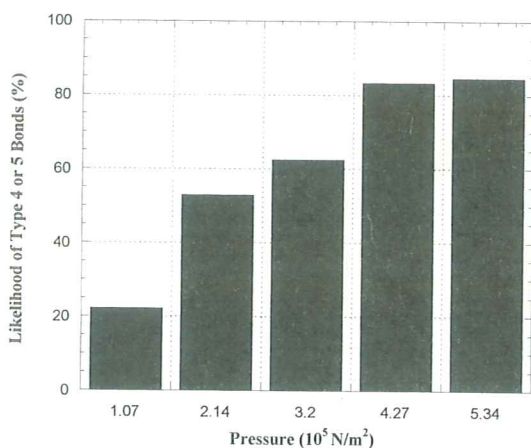


Fig. 3. Likelihood of Good Bond with Pressure only.

5 bond, while pressures greater than $4.3 \times 10^5 \text{ N/m}^2$ have a likelihood of 80% of producing a type 4 or 5 bond.

Table II depicts the experimental data describing the intermediate step where both pressure and temperature are applied to strengthen the bond without shearing the pair. Column (I) through (IV) in Table II have the same parameters as in Table I. The average type of bond corresponding to different pressure is also plotted in Fig. 4. In this case the average bond type improves approximately linearly with pressure requiring greater than $4 \times 10^5 \text{ N/m}^2$ for bonds better than type 4. Figure 5 then plots the likelihood of producing a type 4 or 5 bond with various pressures. These data illustrate that a dramatic

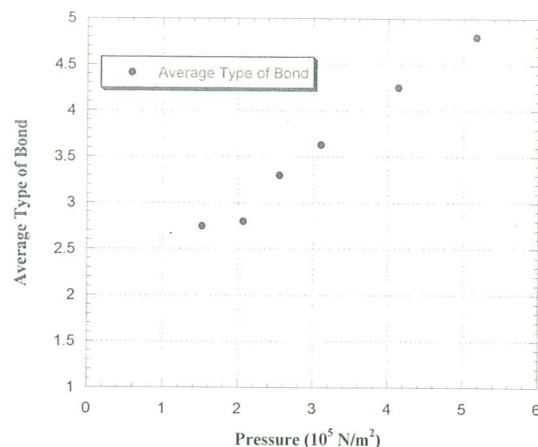


Fig. 4. Average type of bond after pressure and temperature treatment.

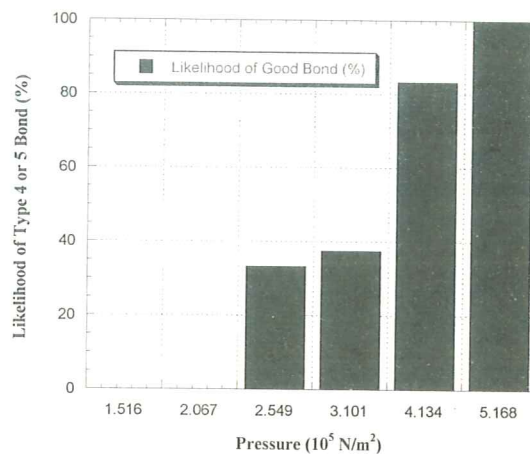


Fig. 5. Likelihood of good bond after pressure and temperature treatment.

improvement in this likelihood occurs for pressures greater than $4 \times 10^5 \text{ N/m}^2$.

Table III shows the type of bond produced at various points with variations in the three-step process described in this paper. Column A) is the normal process, while column C) shows the data where the second step is removed. The pairs of numbers in each column indicate the type of bond before and after the third step anneal. The final bonds in columns A) are of good quality when the bond at the intermediate step was good. Final results in column C) are uniformly poor indicating that step 2 (pressure and temperature) is of critical importance.

5. Conclusions

A systematic low silicon and/or SiO_2 direct bonding process using pressure and temperature is developed in this paper. Oxygen, Argon or Ammonia plasma activation was used to initiate the process. For the case of an oxygen plasma activation it was found that a pressure greater than $2.1 \times 10^5 \text{ N/m}^2$ is needed for step 1. A pressure greater than $4 \times 10^5 \text{ N/m}^2$ at 200°C , 30 min was found necessary for step 2. After appropriate pressures and temperatures in steps 1 and 2 an anneal of 200°C for 24 h is required for the final anneal. After the plasma activates the wafer surface, the first two steps create uniform bonds, while the third step will increase the

bond strength to $> 1,000 \text{ erg/cm}^2$, which is as strong as in the high temperature direct bond. The results of this investigation clearly indicate that the tweezers push can be replaced with a well-defined application of uniform pressure, provided a combination of pressure and temperature is subsequently applied. The standard three-step process follows the pressure and temperature step with a standard anneal; this is found to produce an acceptable process. However, the three-step process may be collapsed into two-step process where a relatively long anneal under pressure is found to produce an excellent bond.

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Appendix

The bonds are rated using a classification of 1 to 5 described in an earlier publication⁶⁾ with 5 being a bond without any voids under IR detector. See Table A-1 for a detailed description of the classification system. Only type 4 or 5 bonds are found to form strong bonds after long time anneal, the strength of the bond is tested after the final anneal to be greater than $1,000 \text{ erg/cm}^2$. Samples of each bond type are shown in Figs. A-1 through A-5.

Table A-1. Bond classification, only type 4 or 5 bonds shown in IR can produce strong bonding where the bond strength is measured $> 1,000 \text{ erg/cm}^2$.

Rating	Description
1	No bond or very weak bond easily to be broken
2	Soft bond, or small region (spot) of solid bond
3	Solid bond to 1/3 of contact area, soft elsewhere
4	Solid bond to 2/3 of contact area, fringe patterns at edges
5	99.9% bonded area, void free

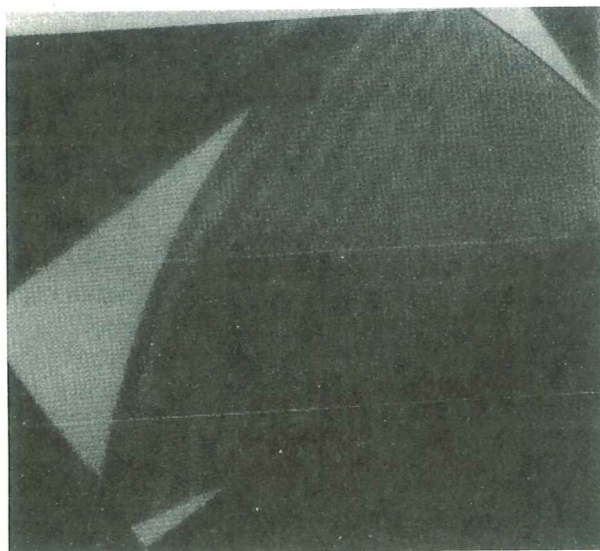


Fig. A-1. Type 1 Bond.

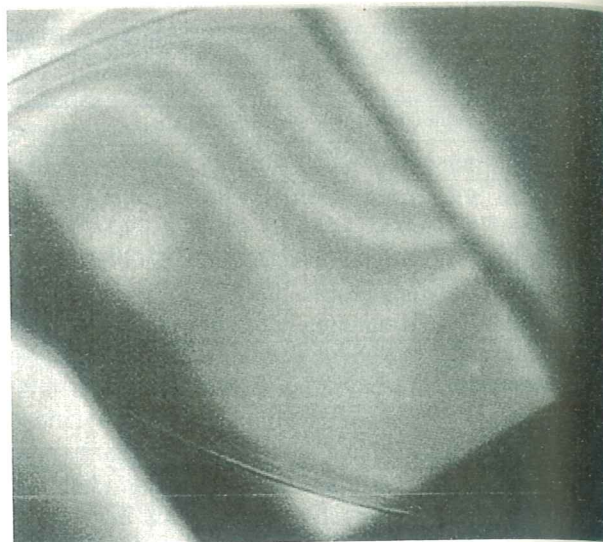


Fig. A-2. Type 2 Bond.

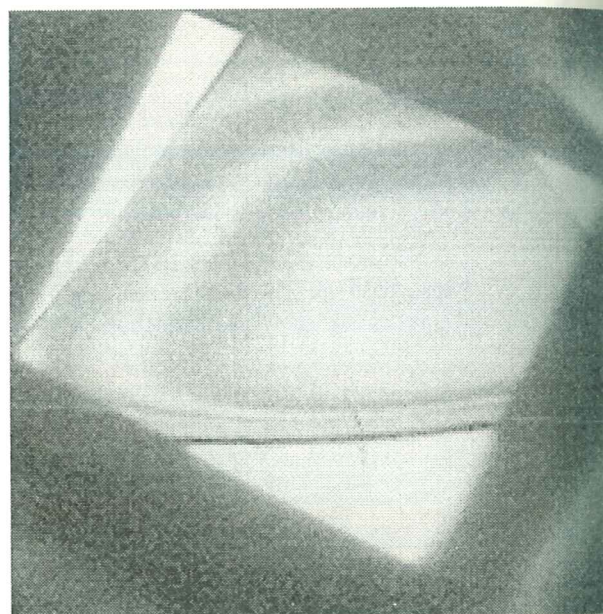


Fig. A-3. Type 3 Bond.

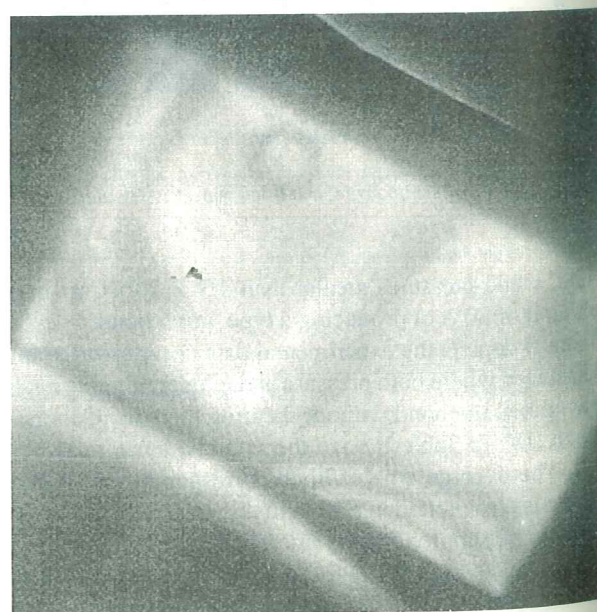


Fig. A-4. Type 4 Bond.

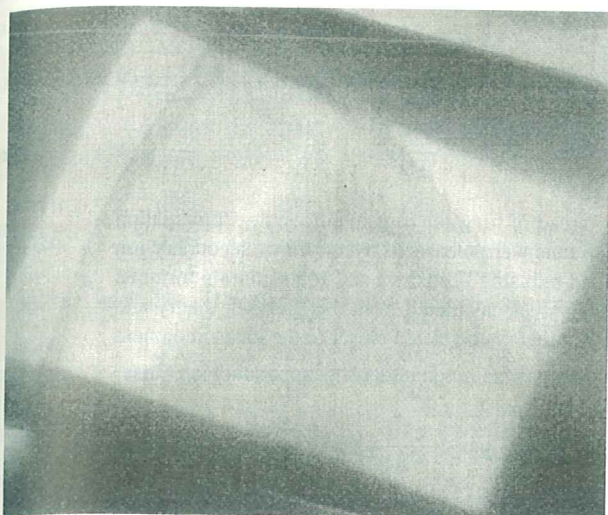


Fig. A-5. Type 5 Bond.

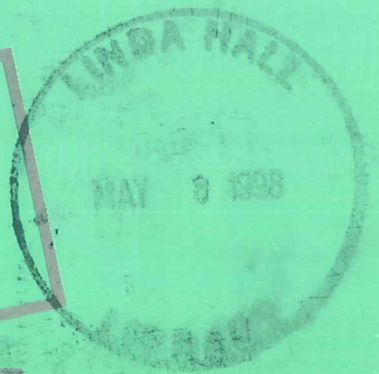
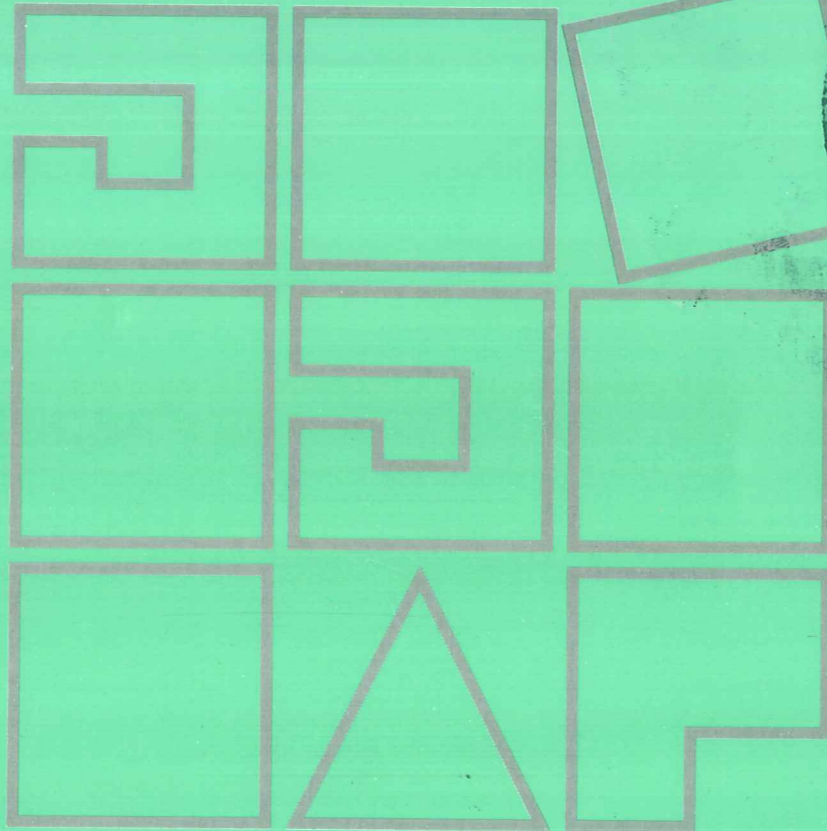
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776 Sho SHIRAKATA and Shigehiro ISOMURA

781 Hee-Bog KANG, Kiyoshi NAKAMURA, Sung-Hwan LIM and Daisuke SHINDO

786 Akira UEDONO, Hiroji EBE, Masahiro TANAKA, Shoichiro TANIGAWA, Kosaku YAMAMOTO and Yoshihiro MIYAMOTO

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796 Ting-Huan CHANG, Jenn-Gee LO, Tung-Cheng KUO, Charles Ching-Hsiang HSU, Swee-Yam YU, Kun-Fu TSENG and Luke Su LU

801 Chang Ju CHOI, Yeo Song SEOL and Ki-Ho BAIK

807 Zhen-Chao DONG, Taro YAKABE, Daisuke FUJITA, Taizo OHGI, Duncan ROGERS and Hitoshi NEJOH

811 Liann-Be CHANG, Yi-Chang CHENG and Hung-Thung WANG

813 Winston K. CHAN

815 Hiroshi INADA, Takao NAKAMURA and Michitomo IYAMA

819 Soon Young JEONG, Zheng Sheng SHAN and David J. SELLMYER

823 Chang-qing XU, Keizo TAKEMASA, Koji NAKAMURA, Hideaki OKAYAMA and Takeshi KAMIHOH

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837 Yoichi KEMMOCHI, Fumio MATSUZAKA and Hiroshi HARA

840 Yong-Feng LU, Wen-Dong SONG, Chong-Kiat TEE, Daniel Siu-Hung CHAN and Teck-Seng LOW

845 Akira NAKAO, Kazunari FUJITA, Toshiaki SUHARA and Hiroshi NISHIHARA

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- Infrared Spectroscopy of the Solid Solution $[K_xNa_{1-x}]_2CO_3$
- Electrical Properties of Condensed Matter**
- Transition of Absorption Spectra due to Electron-Electron Interaction in a Square-Well Quantum Dot under a Magnetic Field
- In-Situ* Observation of the Electrical Conductivity upon Release and Uptake of Oxygen in Indium Tin Oxide Sinter
- Effects of Oxidation on Electrical Conduction and Breakdown of Low-Density Polyethylene Films with Different Densities
- Microwave Dielectric Properties and Microstructures of $(Ba_{1-x}Pb_x)O \cdot La_2O_3 \cdot 4.7TiO_2$ Ceramics
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- Nuclear Science, Plasmas, and Electric Discharges**
- Computational Studies on the Erosion Process in a Magnetron Sputtering System with a Ferromagnetic Target
- A Novel and Convenient Method for Monitoring Processing Plasma: The Insulated Pulse Probe Method
- Density Distributions in a Rectangular Positive Column at Intermediate Pressures (Short Note)
- Atoms, Molecules, and Chemical Physics**
- Photovoltaic Effects of Retinal-Related Materials in Langmuir-Blodgett Films
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- Structure of Trimer-Type Isocyanate Hardening Agents and Reactivity of Their Isocyanate Group
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- 858 A. S. AL-HAWERY
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- 868 Takahisa OMATA, Hiroyuki FUJIWARA, Shinya OTSUKA-YAO-MATSUO and Naoki ONO
- 872 Channarong BANMONGKOL, Tatsuo MORI, Teruyoshi MIZUTANI, Mitsugu ISHIOKA and Iwao ISHINO
- 878 Cheng Chung LEE and Pang LIN
- 885 Ray-Hua HORNG, Dong-Sing WUU, Shih-Hsiung CHAN, Ming-Chung CHIANG, Tiao-Yuan HUANG and Simon Min SZE
- 889 Tatiana SERGAN, Weimin LIU, Jack KELLY and Hiroyuki YOSHIMI
- 895 Hideo FUJIKAKE, Kuniharu TAKIZAWA, Hiroshi KIKUCHI, Takanori FUJII, Masahiro KAWAKITA and Tahito AIDA
- 900 Maeko KAKIZAKI and Teruo HIDEISHIMA
- 903 Wenxiu QUE, Siakpiang LIM, Liangying ZHANG and Xi YAO
- 908 Hiromi TAKAHASHI, Kazutoshi AYUSAWA and Nobuyoshi SAKAMOTO
- 912 Kunihiro OHTANI
- 919 Swapan K. GHOSH, Shigehiro KOMURA, Junichi MATSUBA, Hideki SETO, Takayoshi TAKEDA and Masamichi HIKOSAKA
- 925 Takanori FUKAMI and Ruey-Hong CHEN
- 930 Shin-ichirou HAYASHI
- 938 Masahiko HIRATANI, Choichiro OKAZAKI and Kazumasa TAKAGI
- 942 Zaiyang WANG and Shunri ODA
- 948 Joon Han KIM, Young Soo YOON and Dennis L. POLLA
- 951 Chih-Ming WANG, Ying-Chung CHEN, Maw-Shung LEE, Ju-Wen WU and Chien-Chih CHIOU
- 958 Joon-Hyung AHN, Gwang-Pyo CHOI, Won-Jae LEE and Ho-Gi KIM
- 963 Yoshiharu ONUMA, Zhanhe WANG, Hironobu ITO, Masato NAKAO and KIICHI KAMIMURA
- 965 Shunji IDO, Takeshi SUZUKI and Miekio KASHIWAGI
- 970 Mikio DEGUCHI and Ryohei ITATANI
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- 00520141112104716.0
- 008820324d19822007ja mr p 0 a0eng d
- 010__ |a 88647912 |z sc 83008449 |z sn 82021637
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- 030__ |a JAPNDE
- 035__ |a (OCoLC)8270740
- 035__ |9 383960
- 037__ |b Japanese Journal of Applied Physics, Publication Office, Daini Toyokaiji Bldg., 24-8, Shinbashi 4-chome, Minato-ku, Tokyo 105 Japan
- 040__ |a YDM |c YDM |d WAU |d NST |d FUG |d NST |d IUL |d SER |d NST |d DLC |d NSD |d AIP |d NST |d AIP |d NST |d HUL |d NST |d DLC |d NST |d IUL
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- 042__ |a lc
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- 05000 |a QC1 |b .J28
- 08200 |a 620/.005 |2 20
- 24500 |a Japanese journal of applied physics. |n Part 1, |p Regular papers & short notes.
- 24610 |a Japanese journal of applied physics. |n Part 1, |p Regular papers, short notes & review papers
- 24610 |a Regular papers & short notes
- 24610 |a Regular papers and short notes
- 24610 |a Regular papers, short notes & review papers
- 24610 |a Regular papers, short notes, and review papers
- 260__ |a Tokyo, Japan : |b Publication Board, Japanese Journal of Applied Physics, |c c1982-2007
- 300__ |a v. : |b ill. ; |c 30 cm.
- 310__ |a Monthly
- 3620_ |a Vol. 21, no. 1 (Jan. 1982)-
- 3621_ |a Ceased with vol. 46, no. 12 (Dec. 2007).
- 500__ |a Vol. 40 no. 3B includes a compact disk: International Symposium on Optical Memory 2000.
- 500__ |a Title from cover.
- 500__ |a Issues for Apr. 1992- have title: Japanese journal of applied physics. Part 1, Regular papers, short notes & review papers.
- 500__ |a Publisher varies: April 2000- , Institute of Pure and Applied Physics (IPAP).
- 5101_ |a Computer & control abstracts |x 0036-8113 |b Jan. 1982-
- 5101_ |a Electrical & electronics abstracts |x 0036-8105 |b Jan. 1982-
- 5101_ |a Physics abstracts. Science abstracts. Series A |x 0036-8091 |b Jan. 1982-
- 5102_ |a Chemical abstracts |x 0009-2258
- 5102_ |a Engineering index annual (1968) |x 0360-8557
- 5102_ |a Engineering index bioengineering abstracts |x 0736-6213
- 5102_ |a Engineering index energy abstracts |x 0093-8408
- 5102_ |a Engineering index monthly (1984) |x 0742-1974
- 5102_ |a International aerospace abstracts |x 0020-5842
- 5102_ |a Metals abstracts |x 0026-0924
- 5102_ |a World aluminum abstracts |x 0002-6697
- 530__ |a Issued also on microfiche and microfilm.
- 546__ |a English, French or German.
- 550__ |a "Published monthly with the cooperation of the Physical Society of Japan and the Japanese Society of Applied Physics."
- 650_0 |a Physics |v Periodicals
- 650_0 |a Technology |v Periodicals
- 7102_ |a Nihon Butsuri Gakkai
- 7102_ |a Ōyō Butsuri Gakkai.

- 78001 |t Japanese journal of applied physics |x 0021-4922 |w (OCOLC)1695609 |w (DLC) 64000815
- 78500 |t Japanese journal of applied physics (2008) |w (OCOLC)191921897
- 850__ |a AAP |a AU |a ArU |a AzU |a CSt |a CU |a CU-A |a CU-I |a CU-RivA |a CU-S |a CU-SB |a CaAEU |a CaNSHD |a CaOLU |a CaOOM |a CaOWA |a CaOWtU |a CaSSU |a CoFS |a CtY-KS |a DLC |a DeU |a FU |a ICU |a ICarbS |a IEN |a IU |a IaAS |a InLP |a InU |a KMK |a LU |a MBMU |a MChB |a MCM |a MH-GM |a MMeT |a MdU |a MiU |a MnU |a MoKL |a MoU |a NRU |a NSyU |a NcRS |a NcWsW |a NhU |a NjP |a NjR |a OkS |a OkU |a OrCS |a OrU-S |a PU |a RPB-S |a TU |a TxArU |a TxCM |a TxDaM |a TxLT |a UU |a ViBibV |a ViW |a WaU
- 890__ |a Japanese journal of applied physics. Part 1, Regular papers & short notes.
- 901__ |c Ser
- 936__ |a Vol. 31, no. 7 (July 1992) LIC
- 948__ |a LTI 09/01/2008
- 948__ |a LTI 02/05/2009
- 948__ |a LTI 03/09/2009

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090 \$b

210 00 Jpn. j. appl. phys., Pt. 1

245 00 Japanese journal of applied physics. \$n Part 1, \$p Regular papers & short notes.

246 1 \$i Issues for Apr. 1992-2004 have title: \$a Japanese journal of applied physics. \$n Part 1, \$p Regular papers, short notes & review papers

246 1 \$i Issues for 2005- have title: \$a Japanese journal of applied physics. \$n Part 1, \$p Regular papers,
brief communications & review papers

246 1 \$i Also known as: \$a JJAP. \$n Part 1, \$p Regular papers & short notes

246 30 Regular papers & short notes

246 30 Regular papers and short notes

246 30 Regular papers, short notes & review papers

246 30 Regular papers, short notes, and review papers

246 30 Regular papers, brief communications & review papers

246 30 Regular papers, brief communications and review papers

260 Tokyo, Japan : \$b Publication Board, Japanese Journal of Applied Physics, \$c c1982-

300 v. : \$b ill. ; \$c 30 cm.

310 Monthly

362 0 Vol. 21, no. 1 (Jan. 1982)-

362 1 Ceased with vol. 46, no. 12 (Dec. 2007).

500 Title from cover.

500 Mar. 2001 accompanied by DVD-ROM.

510 2 Chemical abstracts \$x 0009-2258

515 Some no. called special issue; Some no. has two issues called A and B.

515 Issues for <Mar. 2001-> also have continuous numbering: <Tsūkan 536-gō->

530 Also issued on microfiche and microfilm.

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588 Final issue consulted.

650 0 Physics \$v Periodicals.

650 0 Technology \$v Periodicals.

650 6 Ingénierie \$v Périodiques.

650 6 Physique \$v Périodiques.

650 7 Physics. \$2 fast \$0 (OCoLC)fst01063025

650 7 Technology. \$2 fast \$0 (OCoLC)fst01145078

655 7 Periodicals. \$2 fast \$0 (OCoLC)fst01411641

710 2 Nihon Butsuri Gakkai.

710 2 Ōyō Butsuri Gakkai.

710 2 Institute of Pure and Applied Physics.

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785 00 \$t Japanese journal of applied physics (2008) \$w (DLC) 2008228761 \$w (OCOLC)191921897

856 41 \$u <http://www.ipap.jp/jjap/index.htm> \$z Subscription required for access to full text

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891 20 \$9 853 \$8 1 \$a v. \$b no. \$g serial no. \$u 12 \$v r \$i (year) \$j (month) \$w m \$x 01

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